I. Introduction/Planning Process

A. Statement of the Problem

Natural hazards are a part of the world in which we live. Floods, hurricanes, tornadoes, winter storms, wildfires, and other hazardous events are natural phenomena. Natural hazards are inevitable and there is little humans can do to control force and intensity. However, how the natural and the built environments interact with hazards is quite different.

The natural environment is amazingly recuperative from the forces of wind, rain, fire and earth and can regenerate with resiliency, restoring habitat and ecosystems in time for the next generation of plant and animal life to begin anew. The built environment, however, is not as resilient. Natural disasters occur when human activity in the form of buildings, infrastructure, agriculture and other land uses are located in the path of the destructive forces of nature.[I-1] Since the built environment is more susceptible to natural hazards and cannot recuperate like the natural environment, communities impacted by a natural hazard often recover only over a long period of time and at great social and economic cost.

In recent years, the frequency and impact of natural disasters has increased not because natural hazards occur more frequently but because more people are choosing to live and work in locations that put them and their property at risk. "By the year 2015 the number of people residing in the most hurricane-prone counties throughout the nation will have doubled. Likewise, while floods have caused a greater loss of life and property and have disrupted more families and communities than all other natural hazards combined, the rate of development in flood-prone areas continues to escalate, putting more people and property in danger." [I-2]

While natural hazards cannot be prevented, local communities can use various means to reduce the vulnerability of people and property to damage. Communities can reduce exposure to future natural hazards by managing the location and characteristics of both the existing and future built environment. By utilizing location and construction techniques, a community can mitigate negative impacts and reduce future damage to both human lives and property.

Preparing for natural hazards involves establishing a comprehensive emergency management system consisting of the following four component activities:

1. Preparedness activities undertaken to improve a community's ability to respond immediately after a disaster. Preparedness activities include the development of response procedures, design and installation of warning systems, exercises to test emergency operational procedures, and training of emergency personnel.
2. Response activities designed to meet the urgent needs of disaster victims. Response activities occur during the disaster and include rescue operations, evacuation, emergency medical care, and shelter programs.
3. Recovery activities designed to rebuild after a disaster. These activities include repairs to damaged public facilities such as roads and bridges, restoration of public services such as power and water, and other activities that help restore normal services to a community.

Hazard mitigation activities designed to reduce or eliminate damages from future hazardous events. These activities can occur before, during, and after a disaster and overlap all phases of emergency management. Hazard mitigation is defined as "any action taken to eliminate or reduce the long-term risk to human life and property from natural and technological hazards.[I-3] Mitigation activities are ongoing and overlap all phases of emergency management.

Hazard mitigation includes three types of activities:

1. Structural mitigation – constructing dam and levee projects to protect against flooding, constructing disaster-resistant structures, and retrofitting existing structures to withstand future hazardous events;
2. Non-structural mitigation - development of land use plans, zoning ordinances, subdivision regulations, and tax incentives and disincentives to discourage development in high-hazard risk areas; and
3. Educational programs – educating the public about potential natural hazards, the importance of mitigation, and how to prepare to withstand a disaster.

"A fundamental premise of mitigation strategy is that current dollars invested in mitigation activities will significantly reduce the demand for future dollars by reducing the amount needed for emergency recovery, repair, and reconstruction following a disaster. Mitigation also calls for conservation of natural and ecologically sensitive areas (such as wetlands, floodplains, and dunes) which enables the environment to absorb some of the impact of hazard events. In this manner, mitigation programs help communities attain a level of sustainability, ensuring long-term economic vitality and environmental health for the community as a whole." [I-4]

The concept of sustainable development has emerged in recent years as a means to emphasize the need to regain a balance between the built and natural environment. Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".[I-5] Sustainable development centers on the type of development rather than quantity and is not intended to be a no-growth or slow-growth initiative.

"Sustainable development through mitigation is not an impediment to growth. By building a community that is resilient to natural hazards, citizens strengthen the local economy. A locality that reduces its vulnerability will experience less restoration time, shortened business downtime, and less social disruption following a disaster, freeing resources that would otherwise be devoted to response and recovery, and more quickly improving citizens' lives." [I-6]

B. Purpose of the Plan

The purpose of the Plan is:

1. To demonstrate local commitment to hazard mitigation planning principles;
2. To reduce natural hazard vulnerability by reducing the potential for future damages and economic losses;
3. To speed recovery and redevelopment following future natural hazard events;
4. To comply with both State and Federal legislative requirements for local hazard mitigation planning; and
5. To qualify for additional grant funding, in both pre-disaster and post-disaster situations.

C. Authority

The Rolesville Hazard Mitigation Plan (a single jurisdiction plan) was adopted by the Rolesville Board of Commissioners (April 20, 2010) under the authority and general police powers granted to municipalities of the State of North Carolina by North Carolina General Statutes (N.C.G.S., Chapter 160A). The Plan has been developed in accordance with current criteria governing the development of local hazard mitigation plans including 1) Chapter 166A: North Carolina Emergency Management Act as amended by Senate Bill 300: An Act to Amend the Laws Regarding Emergency Management as Recommended by the Legislative Disaster Response and Recovery Commission (2001) and 2) the Disaster Mitigation Act of 2000 (Public Law 106-

390, October 30, 2000) that amended the Robert T. Stafford Relief and Emergency Assistance Act.

D. Participants in the Planning Process

The planning process was overseen by the Rolesville Hazard Mitigation Planning Team (Table I-1), which met regularly during the planning process. The Team included Town staff who participated in planning meetings and reviewed and commented on draft reports.

Table I-1: Town of Rolesville HMP Team Members

Agency/Department	Name	Position
Town Board	Gil Hartis	Commissioner
Administration	Bryan Hicks	Town Manager
Planning	Jacob Reynolds	Town Planner
Parks and Recreation	Jerry Ferguson	Athletic Coordinator
Police	Chris Hatton	Sergeant

The town also invited other interested parties including neighboring communities, agencies, business, academia, nonprofits, etc. to be involved in the planning process. These persons were contacted through email and mail to encourage involvement in the public review process. The other affected stakeholders did not comment on the plan.

Table I-2: Other Interested Parties

Agency/Department
Rolesville Chamber of Commerce
North Carolina Department of Commerce – Division of Community Assistance

E. Description of the Planning Process

The Town of Rolesville first started the hazard mitigation planning process in the winter of 2009. The planning process was organized to ensure that individual mitigation projects and initiatives undertaken by the Town are carried out in a cooperative manner such that all local initiatives work together and no single action or project detracts from the overall goal of creating a safer environment for all citizens of Town of Rolesville. The planning process also played an important part in generating community understanding of and support for hazard mitigation by creating a forum for discussion and publicizing the need for hazard mitigation planning. Finally, the planning process incorporated information from the Town's Community Plan, specifically the Future Land Use Map, to analyze development patterns and projections and ensure that mitigation measures would be sufficient.

Public Input

On March 22, 2010 the Town of Rolesville gave public notice of the start of the hazard mitigation planning process at the Planning Board regularly scheduled meeting. The meeting date and subject were announced to the public via a newspaper advertisement published in *The Wake Weekly* on March 8, 2010.

At the meeting, the town manger made a presentation describing the purpose of the hazard mitigation planning process and the schedule for plan development. The draft section of the Plan on hazard identification and analysis was presented. The announcement also included an invitation for the general public to be involved in the planning process. No public comments were received at that meeting.

Public announcement of the meeting also provided a contact phone number for persons who were unable to attend the meeting but who wanted to receive more information about the planning process. During the planning process, drafts of the plan were also available for public review at Town Hall.

The Planning Board reviewed the plan and unanimously recommended the plan on March 22, 2010. The Board of Commissioners held a public hearing on April 5, 2010 and adopted the plan on April 20, 2010 (see attached resolution of adoption).

In the next five years, the public will be continually involved by public announcements though *The Wake Weekly,* public meetings, electronic mailing lists, and the Town's website. All input will be incorporated into the Plan's future revisions.

HMP Team Meetings

The Hazard Mitigation Planning (HMP) Team met several times during the winter of 2009 – 2010. In addition to these meetings, Town staff met to review and discuss draft mitigation actions proposed by each of the Team members.

Table I-3: Plan Meeting Schedule

Meeting Date	Group	Topic
December 3, 2009	Rolesville HMP Team	Established planning team, report procedures, project schedule. Discussed data needs.
February 24, 2010	Rolesville HMP Team	1st Team meeting/project initiation; review of information collected, project schedule, planning steps; discussed additional data needs for each Town department.
April 5, 2010	Town Board	Public hearing.
April 20, 2010	Town Board	Public Hearing/Adoption.

In developing the Plan, the HMP Team followed the planning steps outlined in "Keeping Natural Hazards from Becoming Disasters – A Mitigation Planning Guidebook for Local Governments", NC Division of Emergency Management.

Step 1. Hazard Identification and Analysis

This step involved describing and analyzing the twelve natural hazards to which Wake County and the Town of Rolesville could be susceptible. Appendix A, which represents the results of this planning step, includes historical data on past hazard events and establishes an individual hazard profile and risk index for each hazard based upon frequency, magnitude, and impact. The summary risk assessment at the end of Appendix A serves as the foundation for concentrating and prioritizing local mitigation efforts. The section includes Map A-1 Town of Rolesville Multi-Hazards Map. The Planning Team fully analyzed this section of the plan and no changes were made from the previous update.

Step 2. Community Vulnerability Assessment
This step involved research and mapping, using best available data, to determine and assess current conditions within the community. Appendix B, which contains the results of this planning step, includes a description of community characteristics, an assessment of current conditions, a list of critical facilities, projections for future growth and summary conclusions including an assessment of both current (2010) and projected (2020) future conditions. Appendix B includes three maps: 1) Map B-1 Zoning Map (with multi-hazards overlay): 2) Map B-2 Critical Facilities/Vulnerable Populations Map; and 3) Map B-3 Future Land Use Map (with multi-hazards overlay). The Planning Team fully analyzed this section of the plan and no changes were made from the previous update.

Step 3. Community Capabilities Assessment
This step included a comprehensive examination and evaluation of Town capacity to implement mitigation strategies, a review of local government authority for hazard mitigation planning, a description of local government organization and staff, a review of technical and fiscal capabilities, and a summary statement of local commitment to hazard mitigation planning. The purpose of this step, represented in Appendix C, was to identify any gaps or weaknesses in local programs or regulations, to determine if any existing programs/regulations had the effect of hindering hazard mitigation, and to identify programs/regulations that could be revised or amended to strengthen local hazard mitigation efforts. The Planning Team fully analyzed this section of the plan and no changes were made from the previous update.

Step 4. Form Interim Conclusions
At the conclusion of Steps 1 – 3, the HMP Team developed summary conclusions regarding community vulnerability to natural hazards and local capability for dealing with hazards. The Planning Team fully analyzed this section of the plan and no changes were made from the previous update.

Step 5. Community Goals and Objectives
Steps 1 through 4 also established the foundation for moving forward with developing the mitigation action program. The HMP Team worked together to formulate community goals and objectives prior to developing specific mitigation actions. The Planning Team fully analyzed this section of the plan and no changes were made from the previous update.

Step 6. Mitigation Strategies/Actions
Next the Team cooperated in formulating a comprehensive list of mitigation actions to be undertaken by the Town. This step also included assigning responsibility and establishing a timeline for implementation of each action. The Planning Team updated timelines for each of the actions and assured that each of the actions were still applicable.

Step 7. Procedures for Monitoring, Evaluating and Reporting Progress
The HMP Team developed a procedure for an annual review and progress report on the Plan. The review process provides for the HMP Team and the general public to have input on plan review. The Planning Team fully analyzed this section of the plan and no changes were made from the previous update.

Step 8. Procedures for Revisions and Updates

The HMP Team developed a procedure for a comprehensive review and update of the Plan on a 5-year schedule. The procedure provides for the inclusion of the public. The Planning Team fully analyzed this section of the plan and no changes were made from the previous update.

Step 9. Adoption.
The Town Board of Commissioners adopted the Plan on April 20, 2010.

F. Resolution of Adoption

RESOLUTION OF THE TOWN OF ROLESVILLE BOARD OF COMMISSIONERS
REGARDING THE ADOPTION OF THE UPDATE TO THE
HAZARD MITIGATION PLAN

WHEREAS, the citizens and property within the Town of Rolesville are subject to the effects of natural hazards and man-made events that pose threats to lives and cause damages to property; and

WHEREAS, the Town desires to seek ways to mitigate situations that may aggravate such circumstances; and

WHEREAS, the Legislature of the State of North Carolina has delegated to local governmental units the responsibility to adopt regulations designed to promote the public health, safety, and general welfare of its citizenry; and

WHEREAS, Section 322 of the Federal Disaster Mitigation Act of 2000 states that local governments must develop an "All-Hazards Mitigation Plan" in order to receive future Hazard Mitigation Grant Program funds; and

WHEREAS, it is the intent of the Mayor and Board of Commissioners of the Town of Rolesville to fulfill its obligation in order that the Town will be eligible for assistance in the event that a state of disaster is declared for a hazard event; and

WHEREAS, this plan was first adopted on October 19, 2004; and

WHEREAS, this plan must be updated every five years;

NOW THEREFORE BE IT RESOLVED that the Mayor and Board of Commissioners of the Town of Rolesville, hereby adopts the update to the Town of Rolesville Hazard Mitigation Plan.

Adopted this 20th day of April, 2010

Frank Eagles
Town of Rolesville Mayor

Attest:
Lynn House
Town of Rolesville Clerk

Footnotes

[I-1] Keeping Natural Hazards from Becoming Disasters - A Mitigation Planning guidebook for Local Governments, North Carolina Division of Emergency Management, May 2003, p. 1.

[I-2] Local Hazard Mitigation Planning Manual, North Carolina Division of Emergency Management, November 1998, p.1.

[I-3] Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments, Federal Emergency Management Agency, 1990, p. 4.

[I-4] Local Hazard Mitigation Planning Manual, p. 4.

[I-5] Our Common Future, United Nation's World Commission on Environment and Development, 1987, as quoted in Local Hazard Mitigation Planning Manual, p. 4.

[I-6] Preventing Disasters through Hazard Mitigation, Ana K. Schwab, Popular Government, Spring 2000, p. 12.

II. Mitigation Action Plan

This section of the Plan summarizes study conclusions, outlines community goals and objectives, and describes the action plan to reduce the vulnerability of the Town of Rolesville to the effects of natural hazards. Mitigation objectives are designed to support community goals while further defining the parameters for development of mitigation actions. Mitigation actions describe specific steps that are to be undertaken to achieve the stated objectives. Mitigation actions are intended to serve as benchmarks for evaluating progress on plan implementation.

A. Study Conclusions

With limited financial and staff resources to dedicate to hazard mitigation, it is essential that those hazards with the highest likelihood of occurrence and the greatest potential impact receive the highest investment of Town resources. Through hazard identification and analysis and vulnerability assessment, it has been determined that the Town of Rolesville is susceptible to the impact of certain natural hazards as summarized at the conclusion of Appendix A Hazard Identification and Analysis of the Wake County Hazard Mitigation Plan.

The Town is not at risk for coastal erosion, tsunamis, or volcanoes and that there is "low" risk of riverine erosion, dam and levee failures, earthquakes, and landslides/sinkholes, these hazards were not addressed. Six hazards were rated either "moderate" or "high" risk - droughts and heat waves; floods; hurricanes and coastal storms; severe storms and tornadoes; wildfires; and winter storms and freezes.

Moderate and High Hazard Threats

Floods

Flooding is often associated with hurricanes and coastal storms (most often general flooding) as well as with severe summer storms (typically flash flooding). Floods are the easiest hazard to quantify and isolate as flooding occurs only in known locations. The severity of a flood is generally dependent upon the amount of rainfall and prior soil conditions (including ground cover). Flood hazard vulnerability can be decreased through adoption and enforcement of local land use regulations and through cooperative, regional efforts to ensure that upstream jurisdictions are not contributing to downstream flooding problems.

High Winds (Severe Storms/Tornadoes and Hurricanes/Coastal Storms)

Severe storms and tornadoes as well as hurricanes and coastal storms present high wind hazards. This hazard is mainly combated through building codes and construction. Enforcement of the current State building code and enhancement of the code in regards to wind resistance will prove the most beneficial in addressing high winds.

Wildfires

Fortunately, wildfires in North Carolina, although frequent, are not normally a serious threat to large areas as is the case in western states where dry weather conditions and large expanses of timber increase the likelihood and extent of the impact of a wildfire. The North Carolina Division of Forest Resources has the responsibility for protecting state and privately owned forest land from wildfires. The program is managed on a cooperative basis with all one hundred counties in the State. The State fire program emphasizes fire prevention

efforts; pre-suppression activities (including extensive training of personnel); aggressive suppression efforts on all wildfires; and law enforcement follow-up.

Droughts and Heat Waves

In general, communities can have little influence or impact on mitigating the impact of droughts/heat waves on the local government level except through ensuring adequate water supplies for normal circumstances and through implementation of water conservation measures when drought conditions are imminent. Similarly, heat waves have wide ranging effects that are almost impossible to combat on a level government level. Communities, therefore, depend upon State and Federal agencies for assistance.

Winter Storms and Freezes

Local governments also look to the State and to private utility companies for leadership in dealing with winter storms/freezes. The typical effects of snow and ice accumulation - loss of electrical power, phone, and cable service and treacherous road conditions - can be only minimally addressed at the local level. (The exceptions would be larger cities which have more snow/ice removal equipment and manpower and governments that own the local electrical distribution system.)

Draft Statement of Commitment to Mitigating Impacts of Natural Hazards

Through the act of developing and adopting a Hazard Mitigation Plan, the Town of Rolesville is committing to develop and engage in programs, activities and practices that can be implemented at the local government level to help to mitigate the impacts of future natural hazards. The Town will place primary emphasis on and dedicate resources, as available, to mitigating the effects of flooding. Secondary emphasis will be placed, as practicable at the local level, on mitigating the effects of high winds.

B. Community Goals

The primary goal of all local governments is to promote the public health, safety, and welfare of the citizens of the community. In keeping with this standard, the Town of Rolesville in cooperation with Wake County has developed four goal statements for local hazard mitigation planning. Each goal, purposefully broad in nature, serves to establish parameters that were used in developing more specific objectives and mitigation actions. Consistent implementation of objectives and actions will over time ensure that community goals are achieved.

Goal #1 Protect the public health, safety and welfare by increasing public awareness of hazards and by encouraging most collective and individual responsibility for mitigating hazard risks.

Goal #2 Improve technical capability to respond to hazards and to improve the effectiveness of hazard mitigation actions.

Goal #3 Enhance existing or create new policies and ordinances that will help reduce the damaging effects of natural hazards.

Goal #4 Protect the most vulnerable populations, buildings, and critical facilities through the implementation of cost-effective and technically feasible mitigation actions.

C. Mitigation Objectives

Mitigation objectives are designed to support community goals while further defining parameters for development of mitigation actions. Objectives are numbered to correspond with the goal that each supports.

Objective 1.1 The Town will engage in activities and practices that will help mitigate the impacts of natural hazards.

Objective 1.2 The Town in cooperation with Wake County will implement a public awareness campaign to educate citizens of the possible hazards associated with locating in floodplains and of measures that can be taken to lessen impacts of future floods.

Objective 1.3 The Town will work with Wake County to ensure that emergency services are adequate to protect public health and safety.

Objective 2.1 The Town will commit to limit infrastructure services (water and sewer) to new development in flood hazard areas in order not to actively encourage development to occur in known hazardous areas.

Objective 2.2 The Town will regularly monitor hazard mitigation efforts to ensure that adequate progress is being made towards stated goals.

Objective 3.1 The Town will work to ensure future development occurs in such a way as to protect wetlands, floodplains, and other natural features that serve to reduce flood hazard susceptibility.

Objective 3.2 The Town will increase control over development in the floodplain to prevent increases in flood velocities and levels that endanger both people and property.

Objective 4.1 The Town will work to develop in such a way that the built environment does not occur in any known or predictable pathways of a natural hazard. If this is unavoidable, as in the case of hurricane force winds, the Town (through agreement with Wake County to enforce the State building code) will ensure that new structures are as resilient as possible to the impacts of a natural hazard.

Objective 4.2 The Town will work to limit development in areas that may cause emergency workers to put lives at risk to rescue someone from a structure knowingly built in a hazardous area.

D. Mitigation Actions

The Town of Rolesville has developed the mitigation actions described in Table II-1. Many of these mitigation actions will have a positive effect on mitigating potential damages from most natural hazards. The listed actions do, however, primarily focus on ways the Town can act to lessen and, ideally, eventually prevent future flood losses as the Town grows into areas with known flood hazards.

Mitigation actions were developed and prioritized by the departmental staff responsible for implementation of the specific action. Each department categorized actions as low, moderate or high priority based on assessment of the need for the specific action, the projected cost of implementation, the potential beneficial effects from implementation of the action, and available funding sources. The implementation years – between 2010 and 2015

– were also determined by the responsible departments using projected resources (personnel, vehicles, etc.) and operating funds.
As discussed under Study Conclusions, the planning team determined that some potential actions were more appropriately addressed at the State level due to long established priorities and responsibilities assumed by the State of North Carolina and local governments.

Individual staff departments were responsible for determining:

1. Cost effectiveness, i.e., do returns or savings produced by implementation of the action outweigh the cost of implementation?
2. Environmental impact, i.e., are actions designed to protect environmentally fragile areas as natural storm water storage areas? and
3. Technically feasibility, i.e., can the action be undertaken by the Town using current staff and local funds, State, or Federal funds, or do other funding sources need to be identified?

In developing actions, the Town relied on the following six mitigation policy categories provided by FEMA:

1. Prevention (P) Measures
   Preventive measures are intended to keep hazard problems from getting worse. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or where capital improvements have not been substantial. Examples of prevention measures include:
   (a) Comprehensive land use planning
   (b) Zoning regulations
   (c) Subdivision regulations
   (d) Open space preservation
   (e) Building code
   (f) Floodplain development regulations
   (g) Stormwater management

2. Property Protection (PP) Measures
   Property protection measures protect existing structures by modifying the building to withstand hazardous events, or removing structures from hazardous locations. Examples of property protection measures include:
   (a) Building relocation
   (b) Acquisition and clearance
   (c) Building elevation
   (d) Barrier installation Building retrofit

3. Natural Resource (NR) Protection
   Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their mitigative functions. Such areas include floodplains, wetlands, and dunes. Parks, recreation or conservation agencies and organizations often implement these measures. Examples include:
   (a) Wetland protection
   (b) Habitat protection
   (c) Erosion and sedimentation control
   (d) Best management practices (BMPs)
   (e) Stream dumping

(f) Forestry practices

4. Emergency Services (ES) Measures
   Although not typically considered a mitigation technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:
   (a) Hazard warning system
   (b) Emergency response plan
   (c) Critical facilities protection
   (d) Health and safety maintenance
   (e) Post-disaster mitigation

5. Structural (S) Projects
   Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event. The projects are usually designed by engineers and managed or maintained by public works staff. Examples include:
   (a) Reservoirs, retention and detention basins
   (b) Levees and floodwalls
   (c) Channel modifications
   (d) Channel maintenance

6. Public Information (PI) Activities
   Public information and awareness activities are used to advise residents, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques that the public can use to protect themselves and their property. Examples of measures to education and inform the public include:
   (a) Map information
   (b) Outreach projects
   (c) Library
   (d) Technical Assistance
   (e) Real estate disclosure
   (f) Environmental education

Table II-1 Mitigation Action Plan

Explanation of Columns Action #
Action # corresponds to FEMA mitigation policy categories listed above.

Action
Brief description of each specific action to be undertaken.

Hazard
Hazard which the action addresses.

Objective(s) Addressed
Reference to the numbered objective which the action supports.

Relative Priority
Low, moderate or high priority for funding and implementation.

Funding Sources
State and Federal sources of funds are noted, where applicable.

Responsible Party
Staff department responsible for undertaking the action. Note: The Town Board of Commissioners has ultimate authority to approve any policy, program or regulation revisions.

Target Completion Date
Date by which the action should be completed.

Abbreviations used in Table II-1:

ADM	Administration
EMS	Emergency Medical Services
ENG	Engineering
FIRE	Fire Services
IT	Information Technology
PLG	Planning
POL	Police
PW	Public Works
PS	Public Safety
TM	Town Manager

In the following table, completion dates listed as “ongoing” signify actions that are progressing toward completion but still require further work. As such, dates certain for completion cannot be provided.

Table II-1: Town of Rolesville Mitigation Action Plan

Action #	Action	Hazard	Objective(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date
Preventive (P)							
P-1	UDO: Continue to provide stream and creek buffers, and floodplain and wetland protection.	Flood	3.1	High	Local	PLG	Ongoing
P- 2	UDO: Resource Conservation Areas (RCA) – Continue to protect floodplains, streams, and creeks.	Flood	3.1	High	Local	PLG	Ongoing
P- 3	UDO: Subdivision Standards – Continue to provide protection for residential areas by not allowing residential lots in the floodplain.	Flood	3.2	High	Local	PLG	Ongoing
P- 4	UDO – Ensure buildings are minimum 2' above base flood elevation.	Flood	3.2	High	Local	Wake County	Ongoing
P- 5	UDO: Flood Damage Prevention Overlay District – Continue to restrict and prohibit uses which are dangerous to health, safety, and property. Uses vulnerable to floods are protected.	Flood	3.1 3.2 4.2	High	Local	PLG	Ongoing
P- 6	UDO: Flood Damage Prevention – Ensure control is provided for filling, grading and dredging within floodplains by working with necessary State and Federal Agencies.	Flood	3.1 3.2	Moderate	Local	PLG TM	Ongoing
P- 7	Ensure road standards maintained in disaster preparation for possible use as evacuation routes.	All	1.1	Moderate	Local	PLG	Ongoing
P- 8	Provide adequate water supply through storage and interconnection with other public water systems.	Drought	1.1	Moderate	Local	PW	Ongoing
P- 9	Provide backup power for all critical public facilities (wastewater treatment plant, sewer pump stations, Public Works and Utilities building, and other critical public buildings).	All	1.1	Moderate	Local	City of Raleigh	Ongoing
P- 10	Maintain major town transportation routes through snow and ice removal contracts and equipment.	Severe Winter Storms	1.1 2.2	Moderate	Local	ADM	Ongoing
P- 11	Require Engineered Storm Water Control Structures where necessary.	Flood	2.2 3.1	Moderate	Local	PLG	Ongoing

Action #	Action	Hazard	Objective(s) Addressed	Relative Priority	Funding Sources	Responsible Party	Target Completion Date
			3.2				
P- 12	Town regularly backs-up information pertaining to Town government in case of an emergency.	All	1.1 1.3 2.2	Moderate	Local	TM	Ongoing
P- 13	Transportation Plan – Continue to address disaster preparedness (evacuation) through road interconnectivity, paved roads, and widening of roads.	All	1.1	Moderate	Local	PLG	Ongoing
Natural Resources (NR) Protection							
NR-1	UDO: Continue to require engineered stormwater controls including stream and wetland protection.	Flood	2.2 3.1 3.2	Moderate	Local	PLG	Ongoing
NR-2	UDO: Flood Damage Prevention Overlay District - continue to prohibit any development in floodway to protect floodplains and wetlands.	Flood	3.1 3.2	Moderate	Local	PLG	Ongoing
NR-3	Develop Open Space Ordinance to protect wildlife habitat.	All	1.1	Moderate	Local	PLG	Ongoing
NR-4	UDO: Incorporate regulations for illicit discharge control in Phase II Stormwater Management Plan.	Flood	1.1	Moderate	Local	PLG	Ongoing
NR-5	UDO -Stream Dumping – Through the NPDES Phase II Stormwater program, the Town will design and implement an illicit discharge program which will enforce regulations against illegal stream dumping.	Flood	1.1	Low	Local	ENG	Ongoing
Emergency Services (ES) Measures							
ES-1	Emergency Operations Command Post Center – established when natural hazard is imminent. Center coordinates evacuations, sheltering, staging areas for equipment, manpower, and needed supplies. Equipment includes internet access, telephone, wireless communications, radio and backup supplied by emergency batteries and/or generators.	All	1.1 2.2	High	Local	TM FIRE EMS POL	Ongoing
ES-2	Ongoing provision of emergency assistance as needed.	All	1.1	High	Local	POL EMS FIRE	Ongoing
ES-3	Ensure hazard warning methods include television, radio, internet and, if needed, emergency vehicles with	All	1.1 2.2	Moderate	Local	FIRE EMS	Ongoing

	loud speaker systems.					POL	
ES-4	Maintain open lines of communication between all branches of emergency response personnel.	All	1.1 1.3	Moderate	Local	IT	Ongoing
ES-5	Prepare for emergency situations – weather station, local weather warning system, and emergency management.	All	1.3	Moderate	Local	FIRE	Ongoing
ES-6	Standard Operating Guidelines – collection of procedures to be followed during emergencies.	All	1.3	High	Local	FIRE	Ongoing
ES-7	Continue Pre-Fire Incident Plan program for all commercial facilities within the Town limits.	All	1.3	High	Local	FIRE	Ongoing
ES-8	Maintain contact information for local businesses in case of an emergency.	All	1.3	High	Local	FIRE	Ongoing
ES-9	Continue to evaluate and improve response and recovery methods following each hazard event.	All	1.3 2.2	High	Local	FIRE POL TM	Ongoing
ES-10	Health and safety maintenance – provide assistance with security and post storm clean-up.	All	1.3	High	Local	POL	Ongoing
ES-11	Post disaster response – building inspections personnel will respond as needed.	All	1.3	Moderate	Local	Wake County	Ongoing
ES-12	Counseling – Police psychologist and Critical Incident Stress Debriefing Team training to provide debriefing sessions for personnel.	All	1.3	High	Local	PS	Ongoing

Public Information (PI) Activities							
PI-1	Town website - develop hazard mitigation section covering such items as public access, evacuation routes, emergency contact numbers, and detailed weather reports in case of emergency,	All	1.1 1.3	Moderate	Local	IT	Ongoing
PI-2	Hazard Disclosure – Maintain geographic information systems (GIS) map to increase public awareness of known hazard locations.	Flood	1.1 4.2	Moderate	Local	PLG	Ongoing
PI-3	Develop planned park to include nature trails and environmental education center.	Flood	1.2	High	Local Wake County	TM	Ongoing
PI-4	Town Hall – Maintain and update hazard information accessible to the public.	All	1.1 1.2	Moderate	Local	PLG	Ongoing
PI-5	Continue to provide flood maps for public use with staff continuing to be available for public assistance.	Flood	1.1 1.2	High	Local	PLG	Ongoing

III. Plan Implementation

A. Process

The Town of Rolesville Hazard Mitigation Plan will be implemented through the delegation of assignments as specified in this section. Each implementation action includes the assignment of responsibility to specific Town departments along with the establishment of a target date for completion for each activity.

It will be the responsibility of Town Manager to ensure that these strategies are addressed by the target completion dates unless reasonable circumstances, e.g., lack of funding, prevent timely implementation. In the case where a target date is not met, the reason for such failure to complete the activity in a timely manner will be noted in the annual progress report.

B. Funding Sources

Although in the long term hazard mitigation actions will save money by avoiding the loss of lives or property damages, in the short term each action will have an associated cost. The Town of Rolesville will rely heavily on local funding sources to fulfill most Plan obligations; however, the Town will also seek funds from interested State and Federal agencies for both pre- and post-disaster activities. A short description of major disaster assistance programs is included below. More detail on organizations and programs providing funding is included in Appendix D Federal and State Resources.

Federal Programs

Pre-Disaster Mitigation Program – Federal Emergency Management Agency

The Disaster Mitigation Act of 2000 created a national program to provide a funding mechanism that is not dependent on a Presidential disaster declaration. The Pre-Disaster Mitigation (PDM) Program provides funding to states and communities for cost-effective hazard mitigation activities that complement a comprehensive mitigation program and reduce injuries, loss of life, and damage of property.

The funding is based on a 75% Federal share plus a 25% non-Federal share of costs. The non-Federal match can be fully in-kind or cash or a combination of the two. Special accommodations are made for small and impoverished communities who are eligible for 90% Federal share plus 10% non-Federal.

Flood Mitigation Assistance Program – Federal Emergency Management Agency

The Flood Mitigation Assistance Program (FMAP) was established by the National Flood Insurance Reform Act of 1994. This program provides grants for cost effective measures to reduce or eliminate the long-term risk of flood damage to existing structures, with an emphasis on sites that historically have been subject to repetitive losses under the National Flood Insurance Program (NFIP). These grants are also available for planning assistance to identify flood risks and actions to reduce that risk, to provide a process for approving flood mitigation plans, and to provide grants to implement measures to decrease flood loses.

Examples of projects that are eligible for grants under this program include elevating or flood proofing pre-FIRM structures, i.e., structures that were brought into the regulatory floodplain by a revision of the Flood Insurance Rate Maps, to acquire land or structures in flood hazard areas, to relocate or demolish existing structures, to construct detention

or retention ponds to aid in the control of flood waters, to flood proof sewer systems, to modify drainage culverts and to obtain technical assistance, (e.g., hiring a professional consultant).

Hazard Mitigation Grant Program (HMGP) - Federal Emergency Management Agency

The Hazard Mitigation Grant Program (HMGP) provides funding for mitigation measures following a Presidential disaster declaration. The HMGP is funded in most part by the Federal government and administered by state governments. FEMA can fund up to 75% of project costs and the State or local share can be cash or in-kind services.

HMGP funds can be used for projects such as acquisition or relocation of structures from hazard prone areas, retrofitting of existing structures to protect them from future damages, and development of state or local mitigation standards designed to protect buildings from future damages, comprehensive state and local mitigation plans, structural hazard control, and the purchase of equipment to improve preparedness and response.

Public Assistance (Infrastructure) Program – Federal Emergency Management Agency (Section 406)

The Public Assistance (PA) Program provides funding to local governments following a Presidential disaster declaration. Funds may be used for mitigation activities in conjunction with the repair of damaged public facilities and infrastructure. Mitigation activities must be related to eligible disaster-related damages and must directly reduce the potential of future disaster damages.

Projects are evaluated for cost effectiveness, technical feasibility, and compliance with statutory, regulatory and executive order requirements. The evaluation must ensure that the mitigation measures do not negatively impact facility operation or risk from another hazard.

Small Business Administration Disaster Assistance Program - U.S. Small Business Administration

The Small Business Administration (SBA) Disaster Assistance Program provides low-interest loans to businesses following a Presidential disaster declaration. The loans target businesses with repair and replacement of uninsured property damages including real estate, machinery and equipment, inventory, and supplies. Businesses and non-profit organizations are eligible.

Community Development Block Grants - U.S. Department of Housing and Urban Development

The Community Development Block Grant (CDBG) program assists communities in rehabilitating substandard dwelling structures and in expanding economic opportunities, primarily for low-to-moderate-income families. However, as a result of a Presidential disaster declaration, CDBG funds may be used for long-term needs such as acquisition, reconstruction, and redevelopment of disaster-affected areas.

State Programs

Statewide Floodplain Mapping Initiative

The State of North Carolina, through the Federal Emergency Management Agency's Cooperating Technical Community partnership initiative, has been designated as a Cooperating Technical State (CTS). As a CTS, the State will assume primary ownership and responsibility for Flood Insurance Rate Maps (FIRMs) for all North Carolina communities. The Statewide Floodplain Mapping Initiative project will include conducting flood hazard analysis and producing updated, digital FIRMs (DFIRMs).

The State began acquiring raw elevation data for the Cape Fear, Lumber, Neuse, Pasquotank, Tar-Pamlico, and White Oak river basins in December 2000. This first phase of mapping will address these six river basins, which were the basins most impacted by Hurricane Floyd. These six river basins account for approximately one-half of the area of the State, impact 48 counties and 334 incorporated municipalities, and encompass over 21,000 miles of streams and rivers.

The data being collected will be used to develop Digital Elevation Models (DEMs) and updated flood hazard data and to produce draft DFIRMs for the affected counties and communities. Draft DFIRMS for the Neuse and Tar-Pamlico River basins were provided in March 2003, and are scheduled for adoption in September 2003.

This updated flood hazard data will provide current, accurate information for communities and property owners to make sound locating and design decisions when building new structures and infrastructure and when retrofitting existing structures. If consistently used by communities for floodplain management, this information should help to dramatically reduce future flood losses in North Carolina.

Water and Sewer Grant Programs - NC Rural Economic Development Center, Inc.

The Rural Center administers three programs that assist rural communities with development of public water and sewer systems needed to support local economic growth and to ensure a reliable supply of clean water. The programs are funded by appropriations from the NC General Assembly and through proceeds from Clean Water Bonds approved by voters in November 1998.

1. The Supplemental Grants Program enables local governments and qualified non-profit organizations to improve local public water and sewer systems. Projects may address public health, environmental and/or economic development critical needs. Rural Center funds must be used to match other project funds from local or other sources. The maximum grant amount is $400,000.

2. The Capacity Building Grants Program provides funding for local governments to undertake planning efforts that support strategic investments in public water and sewer facilities. Funds typically are used to prepare preliminary engineering reports, master water and sewer plans, capital improvement plans, water and sewer feasibility studies, rate studies and grant applications. The maximum grant amount is $40,000.

3. The Unsewered Communities Grants Program provides funding for the planning and construction of new publicly owned sewer systems. Qualified communities must be unserved by wastewater collection or treatment systems. Unsewered

communities grants are designed to cover 90% of the total project costs, but grants cannot exceed $3 million.

Clean Water Management Trust Fund - CWMTF Board of Trustees
The Clean Water Management Trust Fund was created in 1996 for the purpose of making grants to local governments, state agencies, and conservation non-profit organizations to help finance projects that address water pollution. CWMTF will fund projects that 1) enhance or restore degraded waters; 2) protect unpolluted waters; and/or 3) contribute toward a network of riparian buffers and greenways for environmental, educational, and recreational benefits.

The program is funded annually through a portion of unreserved credit balance in the NC General Fund for a minimum of $30 million per year. The CWMTF Board of Trustees, an independent body of 18 members, has responsibility for allocation of fund revenues.

CAMA Local Planning and Management Grants Program - NC Department of Environment and Natural Resources, Division of Coastal Management
The NC Division of Coastal Management assists local governments within the designated 20 coastal counties with local land use planning and management projects through the CAMA Local Planning and Management Grants Program. Eligible projects include new or updated CAMA land use plans, implementation projects, land use ordinances, beach or waterfront access plans, stormwater management plans, hazard mitigation plans, and capital facilities plans.

Water Resources Development Grant Program - NC Department of Environment and Natural Resources, Division of Water Resources
The Water Resources Development Grant Program funds can be used as the non-Federal share of water resources development projects. Eligible projects include 1) general navigation projects; 2) recreational navigation projects: 3) flood control and water drainage projects; 4) stream restoration; 5) protection of privately owned beaches with public access; 6) land acquisition and facility development for water-based recreation; and 7) aquatic weed control projects.

Natural Heritage Trust Fund
The Natural Heritage Trust Fund was established in 1987 and is funded by 25% of the annual state deed excise stamp tax revenues and a portion of personalized license plate sales. The fund is managed by the Board of Trustees and the Natural Heritage Program in the Division of Parks & Recreation (DPR) in the Department of Environment & Natural Resources (DENR). Since 1987, 332 applications have requested $176 million. $80.6 million has been awarded for 1 project to help protect 145,000 acres of land. (http://ils.unc.edu/parkproject/heritage/nhtf.html).

NC Parks and Recreation Trust Fund (NCPARTF)
The NC Parks and Recreation Trust Fund was established in 1993 and is funded by 75% of the annual state deed excise stamp tax revenues. State parks receive 65%; local parks, 30%; beaches & waterfronts, 5%; and administration, 3%. Approximately $22 million is available each year. The program is managed by the Board of the Parks & Recreation Authority and the Division of Parks & Recreation (DPR) in DENR.

Since 1995, local governments have submitted 549 applications requesting over $76 million for capital improvements and land acquisition. The Parks & Recreation Authority

has approved 226 projects for a total of $33.7 million. Over 1400 acres have been added to local parks. The Authority has approved 140 state park land acquisition and facility projects for a total of $71.7 million. PARTF has funded the addition of 8,466 acres to the State Park System. (http://ils.unc.edu/parkproject/partfund).

Land and Water Conservation Fund (LWCF)
The Land and Water Conservation Fund was established in 1964 to provide for funding for federal land acquisition and to provide matching grants for state and local governments to acquire parkland. The federal government allocated $2.9 million to North Carolina for this program in fiscal year 2002-03 with 60% being reserved for local governments and the remaining 40% for State government.

National Recreation Trails Program
The National Recreation Trails Program provides funds to federal, state and local governments and for non-profit organizations for the acquisition of land for trails, and for the development and maintenance of a trail system. The State of North Carolina was allocated $1.1 million in fiscal year 2002-03 from this program which is managed by the US Department of Transportation.

Million Acres Initiative
When the Million Acre Initiative began in January 1999, approximately 2.8 million acres — 9% of the state — were permanently protected in North Carolina. At least 112,000 additional acres were permanently protected during the initiative's first two years. Upon reaching the million acre goal in 2009, North Carolina will contain at least 3.8 million acres of land are permanently protected through the federal, state and local governments, and private, nonprofit groups. One of the stated objectives of protecting open space is to “reduce the risk to people and (property) from flooding”.

Conservation Income Tax Credit
Established in 1983, the Conservation Income Tax Credit provides a 25% income tax credit for donations of land or easements for conservation purposes. The donor's tax filing must be accompanied by a Certificate of Conservation Benefit from the Department of Environment & Natural Resources (DENR). As of August 2001, approximately 400 individual and corporate property owners had donated 82,000 acres of land or conservation easements worth an estimated $165 million at a cost to the State of $26 million (http://ncctc.enr.state.nc.us/).

North Carolina Farmland Preservation Program
The NC Farmland Preservation Program was established in 1986 and is funded by appropriates from the NC General Assembly. The program is managed by the NC Department of Agriculture and Consumer Services and contracted to the Conservation Trust for N.C (CTNC). The General Assembly has appropriated $2.45 million to the program since 1998. The 2001 appropriation of $200,000 was expended on nine grants awarded to help local land trusts and counties with farmland protection programs work with farm families to arrange permanent conservation easements on over 4,270 acres and large parts of 30 farms. These grants have leveraged over $20 million from other private and public funding sources and donations of development rights from farm owners. (www.info@ctnc.org or www.ctnc.org).

Conservation Grants Fund

The Conservation Grants Fund program was created in 1997 for the purpose of providing subsidies to non-profit land trusts to aid in transaction costs related to the donation of land, and to provide for staff and volunteer training. This program has never been funded.

Local Sources

Local governments (counties and municipalities) depend upon local property taxes as their primary source of revenue. Property taxes are typically used to finance services that must be available and delivered on a routine basis to the general public, e.g., counties – social services, schools, etc.; municipalities – water, sewer, solid waste management. If local budgets allow, these funds can also be used for other purposes in the general public interest which would include programs to further hazard mitigation planning. Local funds are most effective when used as local match for Federal and State grant programs.

Non-Governmental Sources

Another potential but typically less available source of funds for implementing local hazard mitigation projects are monetary contributions from non-governmental organizations such as private sector companies, churches, charities, community relief funds, the Red Cross, hospitals, land trusts and other non-profit organizations interested in the environment or the plight of persons affected by disasters.

IV. Plan Review and Update

Periodic monitoring and reporting of progress is required to ensure that Plan goals and objectives are kept current and that local mitigation efforts are being accomplished. The Town of Rolesville Hazard Mitigation Plan shall be reviewed annually or more often as the local situation may require following a disaster declaration to ensure that progress is being made on achieving stated goals and objectives. The Plan will also undergo periodic evaluation and update as required by FEMA and the State.

A. Annual Review/Progress Report

The Town Manager shall direct the Planning Director to take responsibility for conducting the annual review. The annual review shall include the solicitation of comments from affected town departments through re-initiation of the hazard mitigation team planning process utilized during development of the Plan. Other interested parties and the general public will be notified through a variety of media, including but not limited to, local newspapers, the Town of Rolesville website (*www.ci.**rolesville**.nc.us/*), and mailed or emailed notices, of the review process and the opportunity to comment on the Plan report.

The annual review shall ensure:

1. That the Town of Rolesville Planning Board receives an annual report and/or presentation on the progress of Plan implementation. The report will include a status report on the implementation of mitigation actions.
2. That the Town of Rolesville Board of Commissioners receives an annual report and/or presentation on the progress of Plan implementation along with a recommendation from the Planning Board regarding on-going implementation of the Plan.
3. The annual report will include an evaluation of the effectiveness and appropriateness of the mitigation actions included in the Plan. Specifically, the report will attend to the following questions:
    a. Do Plan goals and objectives continue to address current and expected conditions?
    b. Has the nature or magnitude of risks changed?
    c. Are current resources sufficient and appropriate for Plan implementation?
    d. Are there any implementation problems, i.e., technical, political, legal or coordination issues with other agencies?
    e. Are implementation outcomes as expected?
    f. Have other agencies and partners participated as proposed?
4. The annual report will recommend, as appropriate, any necessary revisions or amendments to the Plan.

If the Town of Rolesville Board of Commissioners determines that the recommendations warrant amendment of the Plan, the Board may initiate an amendment through the process described below.

B. Plan Review and Update

Periodic evaluation and revision of the Plan will help ensure that local mitigation efforts include the latest and most effective mitigation techniques. These periodic revisions may also be necessary to keep the County plan in compliance with Federal and State statutes and regulations. The Plan will need to be updated to reflect changes, such as new development in

the area, implementation of mitigation efforts, revisions of the mitigation processes, and changes in Federal and State statutes and regulations.

In the context of a Federal disaster declaration, State and local governments are allowed to update or expand an existing plan to reflect circumstances arising out of the disaster. An updated plan in this circumstance might include a re-evaluation of the hazards and the jurisdiction's exposure to them, a re-assessment of existing mitigation capabilities, and new or additional mitigation recommendations. The Plan shall be reviewed at a minimum every five (5) years to determine if there have been any significant changes that would affect the Plan. Increased development, increased exposure to certain hazards, the development of new mitigation capabilities or techniques, and changes to Federal or State legislation may affect the appropriateness of the Plan.

Review of the Plan

The procedure for reviewing and updating the Plan shall begin with a report prepared by the Planning Director and submitted to the Planning Board for consideration and recommendation to the Board of Commissioners. The report shall include a summary of progress on implementation of hazard mitigation strategies and a recommendation, as appropriate, for any changes or amendments to the Plan.

The review shall include an evaluation of the effectiveness and appropriateness of the Plan. Specifically, the evaluation shall involve a review of the consistency of day-to-day land use decisions to determine if the hazard mitigation policies are being implemented. The review shall recommend if plan amendments are warranted and if any revisions to regulatory tools (zoning, subdivision regulation, etc.) are necessary to assist in implementing the policies of the Plan.

If the Board of Commissioners determines that such a report raises issues that warrant modification of the Plan, or if the Planning Board recommends that issues have been raised which warrant modification of the Plan, the Board of Commissioners may initiate an amendment as delineated below, or may direct the Town Manager to undertake a complete update of the Plan.

Procedure for Amending the Plan

An amendment to the Plan shall be initiated by the Board of Commissioners either at its own initiative or upon the recommendation of the Planning Board, the Planning Director, or any other person or agency who demonstrates that an amendment should be considered.

Upon initiation of a text or map amendment, the Planning Director shall re-convene the hazard mitigation planning team consisting of affected town departments. Other interested parties as identified through public announcements via newspapers and the Town website *www.ci.**rolesville**.nc.us/* shall be invited to be a part of the review process. The team will consider and reach consensus on the amendment(s) which shall then be forwarded to all affected parties, including, but not limited to, Town departments and other interested agencies such as Wake County and the North Carolina Division of Emergency Management for a forty-five (45)-day review and comment period.

At the end of the comment period, the proposed amendment shall be forwarded along with all review comments to the Planning Board for consideration. If no comments are received from the reviewing department or agency within the specified review period, such shall be noted in the report to the Planning Board.

Planning Board Review and Recommendation

The Planning Board shall review the proposed amendment, the report and recommendation of the Planning Director, and any comments received from other departments and agencies. The Planning Board shall submit a recommendation on the proposed amendment to the Board of Commissioners within sixty (60) days. Failure of the Planning Board to submit a recommendation within this time period shall constitute a favorable recommendation.

In deciding whether to recommend approval or denial of an amendment request, the Planning Board shall consider whether or not the proposed amendment is necessary based upon one or more of the following factors:

a) There are errors or omissions made in the identification of issues or needs during the preparation of the original Plan;
b) New issues or needs have been identified which were not adequately addressed in the original Plan;
c) There has been a change in projections or assumptions from those on which the original Plan was based.

Board of Commissioners Review and Approval

Upon receiving the recommendation of the Planning Board, the Board of Commissioners shall hold a public hearing. The Board of Commissioners shall review the Planning Board recommendation (including the factors delineated above), the report and recommendation from the Planning Director, and any oral or written comments received at the public hearing. Following that review, the Board of Commissioners shall take one of the following actions:

a) Adopt the proposed amendment as presented or with modifications.
b) Deny the proposed amendment.
c) Refer the amendment request back to the Planning Board for further consideration.
d) Defer the amendment request for further consideration and/or hearing.

Appendix A: Hazard Identification and Analysis

A. Introduction

The development of a hazard mitigation plan consists of five steps – 1) identification and analysis of natural hazards that could impact the community, 2) assessment of the community's vulnerability to natural hazards, 3) assessment of the community's capability to respond to a natural disaster, 4) assessment of the community's current policies and ordinances that affect hazard mitigation, and 5) development of hazard mitigation strategies that can be implemented to reduce future vulnerability.(Source: Natural Hazard Center, Pennsylvania State University)

This section includes a description and history of natural hazard events that are known to have specifically affected the Town of Rolesville. Where specific data on hazard events in Rolesville were not available, the Wake County hazard history was included for hazards that typically have a countywide impact, e.g., hurricanes/coastal storms, severe winter weather, etc. Primary data sources are two national databases - the National Climatic Data Center (NCDC - http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms) and the Spatial Hazard Events and Losses Database for the United States (SHELDUS* - http://go2.cla.sc.edu/hazard/db_registration). All historical data searches were conducted for the period 1950 to 2010. Where no information on injuries and deaths or property and crop damages is included, the information was not available from these resources.

*Note: SHELDUS information concerning certain hazards causing fatalities and injuries are in decimal form. Casualties and damages are often listed without specific spatial reference, for instance severe thunderstorms affected Central NC. In order to assign the damage amount to a specific county, SHELDUS divides the total number of fatalities or injuries by the number of counties affected. For example, if a severe thunderstorm affected Chatham, Durham, Wake, and Johnston counties and resulted in 1 fatality, each county would receive a 0.25 rating.

As required by FEMA, all six potential hazards that could affect the Town of Rolesville are profiled in this section of the Plan. The Town of Rolesville Composite Hazard Index Table (Table A-24) includes those hazards that were categorized as either "moderate" or "high" risk based on a review of all six hazard histories.

1. Droughts and Heat Waves
2. Floods
3. Hurricanes and Coastal Storms
4. Severe Storms and Tornadoes
5. Wildfires
6. Winter Storms and Freezes

B. Hazard Analysis - Evaluation Method

The purpose of the hazard analysis is to evaluate the likelihood of experiencing each specific natural hazard in the future, and an estimation of likely intensity and probable level of impact. Each natural hazard was evaluated for three characteristics:

1. Likelihood of Occurrence, i.e., expected frequency;

2. Likely Range of Impact, i.e., predictable size and location of impact; and
3. Probable Level of Impact, i.e., estimated strength and damage potential.

Likelihood of Occurrence

The likelihood, or frequency, of occurrence of a particular hazard within a specific jurisdiction will be classified in one of four categories. These four categories are explained in Table A-1.

Table A-1: Explanation of Hazard Likelihood of Occurrence

Likelihood	Frequency of Occurrence
Highly Likely	Near 100% probability in the next year.
Likely	Between 10% and 100% probability in the next year or at least one chance within the next ten years.
Possible	Between 1% and 10% probability in the next year, or at least one chance in the next 100 years.
Unlikely	Less than 1% probability in the next year, or less than one chance in the next 100 years.

Source: "Keeping Natural Hazards from Becoming Disasters", NC Division of Emergency Management, November 2001, p. 11.

Likely Range of Impact

The likely range of impact, or predictable size and location, of a particular hazard within a specific jurisdiction will be classified in one of three categories. These three categories are described in Table A-2.

Table A-2: Description of Likely Range of Impact

Size of Area	Description
Small	10% or less of the total jurisdictional area
Medium	10% to 40% of the total jurisdictional area
Large	40% to 100% of the total jurisdictional area

Source: "Keeping Natural Hazards from Becoming Disasters", NC Division of Emergency Management, November 2001, p. 11.

Probable Level of Impact

The probable level of impact, or estimated strength and damage potential, of a particular hazard within a specific jurisdiction will be classified in one of four categories as described in Table A-3.

Table A-3: Description of Hazard Probable Level of Impact

Level	Area Affected	Impact[1]
Catastrophic	More than 50%	• Multiple deaths. • Complete shutdown of facilities for 30 days or more. • More than 50% of property is severely damaged.
Critical	25 to 50%	• Multiple severe injuries. • Complete shutdown of critical facilities for at least 2 weeks. • More than 25% of property is severely

		damaged.
Limited	10 to 25%	• Some injuries. • Complete shutdown of critical facilities for more than 1 week. • More than 10% of property is severely damaged.
Negligible	Less than 10%	• Minor injuries. • Minimal quality of life impact. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10% of property is severely damaged.

Source: "Keeping Natural Hazards from Becoming Disasters", NC Division of Emergency Management, November 2001, p. 12.

[1] The impact of a natural hazard is a combination of the severity of the occurrence, the magnitude of the event, and the density of human activity in the affected area.

Composite Hazard Index

These three sets of classification categories - likelihood of occurrence, likely range of impact, and probable level of impact – have been combined to create a composite hazard index for each natural hazard. The combined hazard index describes vulnerability in general terms of "low", "moderate" or "high" hazard susceptibility. An individual hazard index is developed at the end of each of the twelve hazard sections. Table A-24 at the end of Appendix A is a composite of the twelve hazard index scores.

Table A-4: Composite Hazard Index Rating[1]

Size of area	Small (1)	Medium (2)	Large (3)	Small (1)	Medium (2)	Large (3)	Small (1)	Medium (2)	Large (3)	Small (1)	Medium (2)	Large (3)
Likelihood of Occurrence / Impact	Catastrophic (4)			Critical (3)			Limited (2)			Negligible (1)		
Highly Likely (4)	9 High	10 High	11 High	8 Moderate	9 High	10 High	7 Moderate	8 Moderate	9 High	6 Moderate	7 Moderate	8 Moderate
Likely (3)	8 Moderate	9 High	10 High	7 Moderate	8 Moderate	9 High	6 Moderate	7 Moderate	8 Moderate	5 Low	6 Moderate	7 Moderate
Possible (2)	7 Moderate	8 Moderate	9 High	6 Moderate	7 Moderate	8 Moderate	5 Low	6 Moderate	7 Moderate	4 Low	5 Low	6 Moderate
Unlikely (1)	6 Moderate	7 Moderate	8 Moderate	5 Low	6 Moderate	7 Moderate	4 Low	5 Low	6 Moderate	3 Low	4 Low	5 Low

[1] Each variable was assigned a number from 1 (lowest) to 3 or 4 (highest) rating. A score from 9 to 11 is a "high hazard risk"; from 6 to 8 "moderate hazard risk"; and from 3 to 5 "low hazard risk".

C. Natural Hazards Identification and Analysis

1. Droughts and Heat Waves

1.1 Droughts *(Source: National Drought Mitigation Center, University of Nebraska)*

Droughts are not rare or random events but normal, recurrent features of climate. Droughts occur in virtually all climatic zones, but drought characteristics vary significantly from one region to another.

Drought is a temporary aberration and differs from aridity which is restricted to low rainfall regions and is a permanent feature of climate. Drought originates from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector.

Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e.- evaporation + transpiration) in a particular area, a condition often perceived as "normal". It is also related to the timing (i.e.- principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e.- rainfall intensity, number of rainfall events) of rain events. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with drought and can significantly aggravate drought severity.

The more recent understanding that a deficit of precipitation has different impacts on groundwater, reservoir storage, soil moisture, snowpack, and streamflow led to the development of the Standardized Precipitation Index (SPI) in 1993. The SPI was designed to quantify the precipitation deficit for multiple time scales. These time scales reflect the impact of drought on the availability of the different water resources. Soil moisture conditions respond to precipitation irregularities on a relatively short scale. Groundwater, streamflow, and reservoir storage reflect longer-term precipitation inconsistencies.

Sequence of Drought Impacts

When drought begins, the agricultural sector is usually the first to be affected because of heavy dependence on stored soil water. Soil water can be rapidly depleted during extended dry periods. If precipitation deficiencies continue, then people dependent on other sources of water will begin to feel the effects of the shortage. Those who rely on surface water (reservoirs and lakes) and subsurface water (ground water), for example, are usually the last to be affected. A short-term drought that persists for 3 to 6 months may have little impact on these sectors, depending on the characteristics of the hydrologic system and water use requirements.

When precipitation returns to normal and meteorological drought conditions have abated, the sequence is repeated for the recovery of surface and subsurface water supplies. Soil water reserves are replenished first, followed by streamflow, reservoirs and lakes, and ground water. Drought impacts may diminish rapidly in the agricultural sector because of its reliance on soil water, but linger for months or even years in other sectors dependent on stored surface or subsurface supplies. Ground water users, often the last to be affected by drought during its onset, may be the last to experience a return

to normal water levels. The length of the recovery period is a function of the intensity of the drought, its duration, and the quantity of precipitation received as the episode terminates.

Severe Droughts in the United States

The period of drought that has been the most well documented in both text and photographs occurred in the 1930s when drought covered virtually the entire Plains area of the U.S. for almost a decade. The most common effect of droughts often involves large amounts of agricultural land. Crops were damaged by deficient rainfall, high temperatures, and high winds, as well as insect infestations and dust storms that accompanied these conditions. The resulting agricultural depression contributed to the Great Depression with bank closures, business losses, increased unemployment, and other physical and emotional hardships. Although records focus on other problems, the lack of precipitation would also have affected wildlife and plant life, and would have created water shortages for domestic needs.

Effects of the Plains drought sent economic and social ripples throughout the country. Millions of people migrated from the drought-stricken areas, often heading west, in search of work. These newcomers were often in direct competition for jobs with longer-established residents, which created conflict between the groups. In addition, because of poverty and high unemployment, migrants added to local relief needs, sometimes overburdening relief and health agencies.

To reduce the impact of future droughts, proactive measures were developed and implemented including an increase in conservation practices and irrigation, average farm size, and crop diversity. Federal crop insurance was established and the regional economy was diversified. Many other proactive measures taken after the 1930s drought also reduced rural and urban vulnerability to drought, including new or enlarged reservoirs, improved domestic water systems, changes in farm policies, new insurance and aid programs, and removal of some of the most sensitive agricultural lands from production.

Table A-6: Palmer Drought Severity Index

-4.0 or less (Extreme Drought)
-3.0 or -3.9 (Severe Drought)
-2.0 or -2.9 (Moderate Drought)
+2.0 or +2.9 (Unusual Moist Spell)
+3.0 or +3.9 (Very Moist Spell)
+4.0 or above (Extremely Moist)

Source: National Climatic Data Center.

Table A-7: History of Drought in North Carolina and the U.S.

Year	Description
1980	The drought/heat wave summer of 1980 caused over $20 billion in damages to agriculture and related industries and an estimated 10,000 heat stress-related deaths in the United States.

Year	Description
1986	$1 - $1.5 billion in damages and an estimated 100 deaths nationwide.
1988	Over $40 billion in damages and 5,000 to 10,000 deaths across central and eastern United States.
1993	During June-July 1993 most of the Southeast received less than 50% of normal rainfall along with temperatures 3 – 6 degrees above normal. Eighty-nine of the one hundred counties in NC were declared disaster areas. Crop losses for NC were estimated at $165 million. During this period, North Carolina also recorded the second driest summer (June-August) on record (since 1895) with a statewide average precipitation of only 9.43 inches. The Raleigh-Durham area recorded the driest June on record with 0.33 inches of rain. Estimated damages for the United States exceeded $1 billion in damages to agriculture and at least 16 deaths.
1998	Severe drought/heat wave from Texas/Oklahoma eastward to the Carolinas resulted in $6 - $9 billion in damages to agriculture and at least 200 deaths.
1999	Summer drought/heat wave of 1999 resulted in extensive agricultural losses estimated at over $1.0 billion in damages and an estimated 502 deaths in the United States. The east coast was hardest hit by the drought, with record and near-record short-term precipitation deficits occurring on a local and regional scale resulting in agricultural losses and drought emergencies being declared in several states. Drought was especially severe in the mid-Atlantic states, where local water restrictions were in effect and drought emergencies were declared by several governors. February-August 1999 ranked as the fifth driest such period in the 105-year record.
2000	Severe drought and persistent heat over south-central and southeastern states caused significant losses to agriculture and related industries estimated at over $4.0 billion in damages and 140 deaths.
2002	According to the National Climatic Data Center, moderate to extreme drought affected more than 45% of the United States June through August of 2002. Nationwide, the summer of 2002 was the third hottest on record after the summers of 1934 and 1936. The 12 months that ended with August 2002 were the driest on record for North Carolina. Local water restrictions were in effect throughout central and western North Carolina.
2008	Severe drought and persistent heat over south-central and southeastern states caused significant losses to agriculture and related industries.

Source: National Climatic Data Center.

1.2 Heat Waves

Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. Among large natural hazards, only the cold of winter -- not lightning, hurricanes, tornadoes, floods, or earthquakes – takes a greater toll. In the 40-year period from 1936 through 1975, nearly 20,000 people in the United States were killed by the effects of heat and solar radiation. In the disastrous heat wave of 1980, more than 1,250 people died as a direct result of the heat wave. People at higher risk, e.g., with aging or diseased hearts, are especially susceptible to excessive heat. In recent years, the National Weather Service (NWS) has stepped up efforts to more effectively alert the general public and appropriate authorities to the hazards of heat waves and prolonged excessive heat/humidity episodes. *(Source: National Oceanic and Atmospheric Administration (NOAA))*

How Heat Affects the Body

Human bodies dissipate heat by varying the rate and depth of blood circulation, by losing water through the skin and sweat glands, and -- as the last extremity is reached -- by panting, when blood is heated above 98.6 degrees. As heat rises, the heart begins to pump more blood, blood vessels dilate to accommodate the increased flow, and the

bundles of tiny capillaries threading through the upper layers of skin are put into operation. Blood is circulated closer to the skin's surface, and excess heat drains off into the cooler atmosphere. At the same time, water diffuses through the skin as perspiration. The skin handles about 90 percent of the body's heat dissipating function. Sweating, by itself, does nothing to cool the body, unless the water is removed by evaporation -- and high relative humidity retards evaporation.

Heat disorders generally have to do with a reduction or collapse of the ability of the body to shed heat by circulatory changes and sweating, or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise and heat-related illness may develop.

Ranging in severity, heat disorders share one common feature: the individual has overexposed or over exercised for his/her age and physical condition in the existing thermal environment. Sunburn, with its ultraviolet radiation burns, can significantly retard the skin's ability to shed excess heat. Studies indicate that, other things being equal, the severity of heat disorders tend to increase with age -- heat cramps in a 17-year-old may be heat exhaustion in someone 40 and heat stroke in a person over 60.

Heat Index

The heat index, given in degrees Fahrenheit, is an accurate measure of how hot it really feels when the relative humidity is added to the actual air temperature (see Table A-7 Heat Index Chart). If the air temperature is 95°F (found on the left side of Table A-7), and the relative humidity is 50% (found at the top of Table A-7), the heat index - or how hot it really feels - is 106.7°F. This is at the intersection of the 95° row and the 50% column. Since heat index values were devised for shady, light wind conditions, exposure to full sunshine can increase these values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous. In Table A-7, the shaded zone above 95°F corresponds to a heat index level that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

Table A-8: Heat Index Chart

Temperature (F) versus Relative Humidity (%)									
°F	90%	80%	70%	60%	50%	40%	30%	20%	10%
65	65.6	64.7	63.8	62.8	61.9	60.9	60.0	59.1	58.1
70	71.6	70.7	69.8	68.8	67.9	66.9	66.0	65.1	64.1
75	79.7	76.7	75.8	74.8	73.9	72.9	72.0	71.1	70.1
80	88.2	85.9	84.2	82.8	81.6	80.4	79.0	77.4	76.1
85	101.4	97.0	93.3	90.3	87.7	85.5	83.5	81.6	79.6
90	119.3	112.0	105.8	100.5	96.1	92.3	89.2	86.5	84.2
95	**141.8**	131.1	121.7	113.6	106.7	100.9	96.1	92.2	89.2
100	**168.7**	**154.0**	**140.9**	129.5	119.6	111.2	104.2	98.7	94.4
105	**200.0**	**180.7**	**163.4**	**148.1**	**134.7**	123.2	113.6	105.8	100.0
110	**235.0**	**211.2**	**189.1**	**169.4**	**151.9**	**136.8**	124.1	113.7	105.8
115	**275.3**	**245.4**	**218.0**	**193.3**	**171.3**	**152.1**	**135.8**	122.3	111.9
120	**319.1**	**283.1**	**250.0**	**219.9**	**192.9**	**169.1**	**148.7**	**131.6**	118.2

Source: National Weather Service Heat Index Program, NOAA.

Heat Index/Heat Disorders

The Heat Index/Heat Disorders (Table A-8) relates ranges of heat index with specific disorders, particularly for people in higher risk groups. Heat disorder symptoms are described in Table A-9.

Table A-9: Heat Index/Heat Disorders

Prolonged Exposure or Physical Activity	HI	Possible Heat Disorder
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and physical activity.
Extreme Caution	90°F - 105°F	Sunstroke, heat cramps and heat exhaustion possible.
Danger	105°F – 130°F	Sunstroke, heat cramps, and heat exhaustion likely, and heat stroke possible.
Extreme Danger	**130°F or greater**	**Heat stroke highly likely with continued exposure.**

Source: National Weather Service Heat Index Program, NOAA.

Table A-10: Heat Disorder Symptoms

Heat Disorder	Symptoms	First Aid
Sunburn	Redness and pain. In severe cases, swelling of skin, blisters, fever, headaches.	Ointment for mild cases if blisters appear. If breaking occurs, apply dry sterile dressing. Serious cases should be seen by a physician.
Heat Cramps	Painful spasms usually in muscles of legs and abdomen possible. Heavy sweating.	Firm pressure on cramping muscles, or gentle massage to relieve spasm. Give sips of water. If nausea occurs, discontinue use.
Heat Exhaustion	Heavy sweating, weakness, skin cold, pale and clammy. Shallow or weak pulse. Normal temperature possible. Fainting and vomiting.	Get victim out of sun. Lie down and loosen clothing. Apply cool wet cloths. Fan or move victim to air conditioned room. Sips of water. If nausea occurs, discontinue use. If vomiting continues, seek immediate medical attention.
Heat Stroke/ Sunstroke	High body temperature (106°F, or higher). Hot dry skin. Rapid and strong pulse. Possible unconsciousness.	Heat stroke is a severe medical emergency. Summon medical assistance or get the victim to a hospital immediately. Delay can be fatal. Move the victim to a cooler environment. Reduce body temperature with cold bath or sponging. Use extreme caution. Remove clothing, use fans and air conditioners. If temperature rises again, repeat process. Do not give fluids.

Source: National Weather Service Heat Index Program, NOAA.

Cities Pose Special Hazards

The atmospheric conditions that accompany a heat wave trap pollutants within urban areas and add the risk of severe pollution to the already dangerous stresses of hot

weather, furthermore creating health problems. A map of heat-related deaths in St. Louis during 1966, for example, showed a heavier concentration in the crowded alleys and towers of the inner city, where air quality would suffer during a heat wave.

The high inner-city death rates also can be contributed to lack of access to air-conditioned rooms. The convenience of air-conditioning may be a comfort during normal circumstances; however, during periods of extreme heat, health concerns make it a necessity. The price to maintain air conditioning becomes irrelevant when health concerns take priority. Indications from the 1978 Texas heat wave suggest that some elderly people on fixed incomes, many of them in buildings that could not be ventilated without air conditioning, found the cost too high, turned off their units, and ultimately succumbed to the stresses of heat. Wake County has provided its residents with programs that make available fans to people in need in certain weather related conditions.

Hazard Analysis – Droughts and Heat Waves

*Note: Droughts and heat waves have regional impact thus historical data on the impact of droughts and heat waves in North Carolina (Table A-6) was assumed to have affected the entire county, including the Town of Rolesville.

Likelihood of Occurrence of Droughts and Heat Waves

Since 1980 there have been several periods of significant drought affecting the southeastern portion of the United States. The National Climatic Data Center reported one event of extreme heat for Wake County during 7/22/98, where temperatures reached in excess of 110 degrees. These hazardous events can be considered “likely” in Wake County.

Likely Range of Impact for Droughts and Heat Waves

When droughts and heat waves do occur, they impact several states or an entire region of the United States, therefore, the range of impact can be classified as “large”.

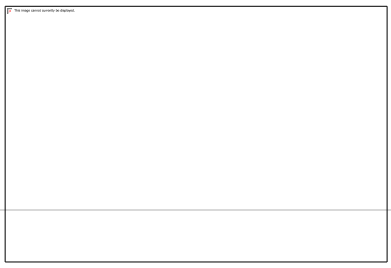
Probable Level of Impact for Droughts and Heat Waves

In rural agrarian societies, extended droughts can have a significant impact on local resources and the economy. However, in more urban areas such as the Town of Rolesville and Wake County, the probable level of impact can be classified as “negligible”.

Town of Rolesville Hazard Index for Droughts and Heat Waves

The hazard index for droughts and heat waves in the Town of Rolesville is categorized as “moderate” based on a “likely” occurrence, “large” range of impact, and “negligible” level of impact. However, mitigating the impact of a drought or heat wave is generally considered a State or regional issue and planned for at those levels. Locally viable strategies include public education and water usage policies.

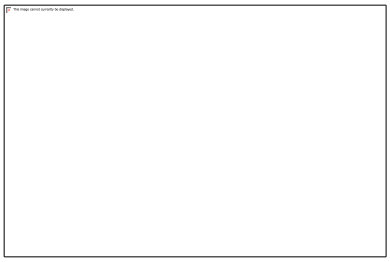
2. Floods (Map A-1: Town of Rolesville Multi-Hazards Map)



Areas susceptible to flood damage caused by heavy rainfall have been determined through the Federal Emergency Management Agency (FEMA) floodplain mapping program. The economic and human impact a hurricane or other heavy rainfall event has on a community depends greatly on how development has

occurred within that community. Development in areas of high risk or vulnerability greatly increases the potential for property damage and loss of life.

Flooding is normally the result of a larger event such as a hurricane, nor'easter or thunderstorm, but flooding can be as frequent as the occurrence of a spring rain or a summer thunderstorm. Flooding is caused by excessive precipitation and can be generally considered in two categories: flash floods and general floods.



Flash floods are the product of localized, high-intensity precipitation over a small drainage basin in a short time period. Flash floods, which typically occur more frequently than general floods, occur along small streams and creeks. The undermining or washing out of roads is typically associated with flash floods. General floods are caused by precipitation over a longer time period and over a given river basin. These larger storm events occur along the East Coast of the United States most often in the late summer and fall. *Photos: Flooding caused by Hurricane Fran (Source: City of Raleigh). Pollution and erosion caused by Hurricane Fran (Source: City of Raleigh)*

A combination of river basin physiography, local thunderstorm movements, past soil moisture conditions, the degree of vegetative clearing and the amount of impervious surface coverage (buildings, pavement, etc) determine the severity of a flooding event. Flooding is typically most severe in areas of the floodplain immediately adjacent to major streams and rivers.

Historic Impact of Floods in Wake County

Since 2004, twenty-two floods have been reported in Wake County (Table A-11). North Carolina Division of Emergency Management has rated Wake County as a "moderate" risk for floods (Local Hazard Mitigation Planning Manual, p.86).

Table A-11: Flood Event Data for Wake County – 1966 - 2009

Location	Date	Time	Type	Damages
Countywide	2/13/1966	N/A	Flooding	$5,000
Countywide	2/28/1966	N/A	Flooding	$500
Countywide	3/4/1966	N/A	Flooding	$5,000
Countywide	9/21/1979	N/A	Flooding	$122,000
Countywide	3/17/1983	N/A	Flooding	$694
Countywide	8/18/1986	N/A	Flooding	$50,000
Countywide	8/20/1986	N/A	Flooding	$500,000
Countywide	10/10/1990	N/A	Flooding	$5,000
Countywide	3/4/1993	N/A	Flooding	$6,000
Countywide	10/22/1990	N/A	Flooding	$500
Northern	6/24/1995	4:05 PM	Flash Flood	$50,000
Northeast Raleigh	8/27/1995	6:40 PM	Flash Flooding	$6,000,000
Raleigh	10/4/1995	3:46 PM	Flash Flood	N/A
Southeast Portion	10/5/1995	9:00 AM	Flash Flood	N/A
Raleigh	9/6/1996	12:30 AM	Flash Flood	N/A
Raleigh/Wendell	9/10/1996	3:40 PM	Flash Flood	N/A
Raleigh	9/10/1996	5:50 PM	Flash Flood	N/A
Raleigh	9/11/1996	6:40 PM	Flash Flood	N/A

Location	Date	Time	Type	Damages
Raleigh	10/8/1996	7:00 AM	Flash Flood	N/A
Raleigh	4/28/1997	11:10 PM	Flash Flood	N/A
Countywide	7/24/1997	6:30 AM	Flash Flood	N/A
Raleigh	1/16/1998	5:00 PM	Flash Flood	$50,000
Raleigh	1/23/1998	12:00 PM	Urban Flood	N/A
Raleigh	3/9/1998	1:50 AM	Flash Flood	N/A
Raleigh	3/19/1998	4:00 AM	Flash Flood	N/A
Raleigh	8/8/1998	2:30 AM	Urban Flood	$20,000
Raleigh	8/16/1998	8:15 PM	Urban Flood	$40,000
Wake Forest	8/26/1999	7:15 AM	Flash Flood	N/A
Countywide	9/05/1999	1:00 PM	Flash Flood	N/A
Countywide	9/15/1999	10:00 PM	Flash Flood	N/A
Countywide	9/27/1999	8:08 AM	Flash Flood	N/A
Countywide	9/28/1999	4:30 PM	Flash Flood	N/A
Raleigh	7/29/2000	1:10 AM	Flash Flood	N/A
Raleigh	8/1/2000	8:50 PM	Flash Flood	N/A
Raleigh	8/4/2000	5:15 PM	Flash Flood	N/A
Fuquay-Varina	8/4/2000	7:36 PM	Flash Flood	N/A
Raleigh	9/3/2000	6:10 PM	Flash Flood	N/A
Raleigh	9/4/2000	2:50 PM	Flash Flood	N/A
Raleigh	9/25/2000	6:30 PM	Flash Flood	N/A
Countywide	6/16/2001	7:10 PM	Flash Flood	N/A
Southern Portion	7/4/2001	8:00 PM	Flash Flood	N/A
Southern Portion	7/9/2001	10:30 PM	Flash Flood	N/A
Holly Springs	8/11/2001	1:00 AM	Flash Flood	N/A
Wake Forest	9/10/2001	6:15 PM	Flash Flood	N/A
Raleigh	3/31/2002	6:45 PM	Flash Flood	N/A
Raleigh	6/28/2002	10:15 PM	Flash Flood	N/A
Raleigh	8/26/2002	3:30 AM	Flash Flood	N/A
Raleigh	10/11/2002	10:30 AM	Flash Flood	N/A
Countywide	3/20/2003	6:30 AM	Flood	$150,000
Countywide	4/10/2003	12:15 PM	Flood	N/A
Raleigh	6/07/2003	8:35 PM	Flash Flood	N/A
Fuquay-Springs	7/17/2003	9:00 PM	Flash Flood	N/A
Raleigh	7/29/2003	2:35 PM	Flash Flood	N/A
East Portion	8/01/2003	7:35 PM	Flash Flood	N/A
Central Portion	8/08/2003	8:10 PM	Flash Flood	N/A
Central Portion	8/08/2003	9:45 AM	Flash Flood	N/A
Fuquay Springs	6/04/2004	1:40 PM	Flash Flood	N/A
Morrisville	7/29/2004	4:30 PM	Flash Flood	N/A
Countywide	8/12/2004	3:35 PM	Flash Flood	N/A
Raleigh	8/13/2004	6:10 PM	Flash Flood	N/A
Raleigh	8/30/2004	6:30 AM	Flash Flood	N/A
Raleigh	6/07/2005	4:07 PM	Flash Flood	N/A
Raleigh	6/07/2005	4:28 PM	Flash Flood	N/A
Garner	6/11/2006	8:20 PM	Flash Flood	N/A
Countywide	4/14/2006	9:00 AM	Flash Flood	N/A
Morrisville	6/23/2006	3:30 PM	Flash Flood	N/A
Raleigh	6/23/2006	3:45 PM	Flash Flood	N/A
Cary	6/23/2006	4:08 PM	Flash Flood	N/A
Brentwood	4/27/2008	7:30 PM	Flash Flood	N/A
Millbrook	4/27/2008	8:00 PM	Flash Flood	N/A

Location	Date	Time	Type	Damages
Cario	8/28/2008	12:00 AM	Flash Flood	N/A
Morrisville	8/30/2008	8:10 PM	Flash Flood	N/A
Echo Heights	8/30/2008	9:15 PM	Flash Flood	N/A
Millbrook	9/06/2008	12:20 AM	Flash Flood	$100,000
Millbrook	5/05/2009	8:15 PM	Flash Flood	N/A
Morrisville	5/05/2009	8:15 PM	Flash Flood	N/A
Brentwood	5/05/2009	8:18 PM	Flash Flood	N/A
Asbury	5/05/2009	8:35 PM	Flood	N/A
Totals				**$7,104,694**

Source: National Climatic Data Center, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms and SHELDUS (Spatial Hazard Events and Losses Database for the United States, http://go2.cla.sc.edu/hazard/db_registration.

Hazard Analysis – Floods

Likelihood of Occurrence of Floods

Localized flooding can occur several times a year within the Town of Rolesville. In recent years there have also been a number of more widespread flooding events caused by hurricanes and tropical storms. The likelihood of localized flooding can be categorized as "highly likely", whereas general flooding can be categorized as "likely".

Likely Range of Impact for Floods

Flooding is normally confined to specific, known flood hazard areas where development can be controlled or limited. The likely range of flood impact can be classified as "small".

Probable Level of Impact for Floods

Localized flooding typically has a "negligible" level of impact within the Town of Rolesville. Given historic trends, the expected flood depth for the Town of Rolesville is not expected to exceed three feet.

Town of Rolesville Hazard Index for Floods

The composite hazard index for floods within the Town of Rolesville is categorized as "moderate" based on a "likely" level of occurrence, "small" range of impact, and "limited" level of impact. This hazard index indicates that flood damage potential should be a focus of local hazard mitigation efforts.

3. Hurricanes and Coastal Storms

Hurricanes are cyclonic low-pressure system storms originating in tropical ocean waters and fueled by latent heat from the condensation of warm water. Hurricanes and tropical storms that affect North Carolina normally form in the Atlantic Ocean off the coast of western Africa between the months of June and November with the peak season occurring in early September. *Photo – Hurricane Fran (Source: NC Office of Archives and History)*

Hurricanes are born over tropical oceans when the water is warmer than about 80 degrees. These storms start as areas of disturbed weather where a combination of clouds and falling pressure combined with the rotation of the earth result in increasing winds. Once these winds mature into hurricanes, they can remain constant for days or they may peak and quickly die. Hurricanes lose power when taken away from a warm water source - which is what happens when a storm moves over land.

Hurricanes and other cyclones that form in the tropics during summer months are different from the extratropical storms (nor'easters) that form during winter months. Both

types of storms produce strong winds and may cause flooding. The main differences between hurricanes and nor'easters are:

- Hurricanes and tropical systems have no fronts.
- Hurricane winds weaken with height.
- The centers of hurricanes are warmer than the surroundings.
- Hurricanes and tropical systems form under weak high-altitude winds.
- Air sinks at the center of a hurricane.
- Latent heat of condensation is the major energy source for hurricanes.
- Hurricanes weaken rapidly when over land.

Tropical Storm Categories

Tropical systems/hurricanes are classified into four categories according to degree of organization and maximum sustained wind speed:

1. Tropical Disturbance/Tropical Wave - unorganized mass of thunderstorms, very little, if any, organized wind circulation.
2. Tropical Depression - evidence of closed wind circulation around a center with sustained winds from 20-34 knots (23-39 mph).
3. Tropical Storm - maximum sustained winds are from 35-64 knots (40-74 mph). A storm is named once it reaches tropical storm strength.
4. Hurricane - maximum sustained winds exceed 64 knots (74 mph).

With favorable atmospheric and oceanic conditions, a storm will intensify from a tropical depression to a tropical storm and then to a hurricane. Heavy precipitation, high winds and tornadoes are all typically associated with hurricanes. Hurricanes have long threatened the North Carolina coast and, as evidenced in recent years, can strongly affect inland areas as well.

The Saffir-Simpson Scale measures hurricane intensity ranging from one (minimal) to five (catastrophic). The scale ratings are based on wind speeds, surface pressure and height of storm surge (Table A-12). To improve storm-rating accuracy, scientists are currently considering revising the Saffir-Simpson Scale to include rainfall potential as a fourth rating variable.

Hurricane Categories

Major hurricanes are categorized as 3, 4 or 5 on the Saffir-Simpson Scale. While hurricanes within this range comprise only 20% of total tropical cyclone landfalls, they account for over 70% of the damage in the United States. Maximum sustained winds of category 3, 4 and 5 hurricanes range from 112 mph to over 156 mph. The higher wind intensities topple trees and cause severe damage to structures.

Table A-12: Saffir-Simpson Hurricane Scale

Category	Barometric Pressure (mb)	Wind Speed (in miles per hour)	Height of Storm Surge (in feet)	Damage Potential
1 Weak	>980.2	74 – 95	4 – 5	Minimal damage to vegetation
2	979.68 –	96 – 110	6 – 8	Moderate damage to

Moderate	965.12			houses
3 Strong	945.14 – 964.78	111 – 130	8 – 12	Extensive damage to small buildings
4 Very Strong	920.08 – 944.80	131 – 155	13 – 18	Extreme structural damage
5 Devastating	<920.08	> 156	> 18	Catastrophic building failures possible

Source: State Climate Office of North Carolina, NC State University.

The National Hurricane Center, describes damages associated with hurricanes categories as:

Category 1
Damage primarily to unanchored mobile homes, shrubbery and trees. Some damage to poorly constructed signs. Also, some coastal road flooding and minor pier damage.

Category 2
Some building roofing material, door and window damage. Considerable damage to shrubbery and trees with some trees blown down. Considerable damage to mobile homes, poorly constructed signs and piers. Coastal and low-lying escape routes flood 2-4 hours before arrival of the hurricane center. Small craft in unprotected anchorages break moorings.

Category 3
Some structural damage to small residences and utility buildings with a minor amount of curtain wall failures. (Curtain walls are typically associated with non-residential buildings where non-structural window and/or wall panels are attached to the structural framework to form the exterior skin of the building.) Damage to shrubbery and trees with foliage blown off trees and large trees blown down. Mobile homes and poorly constructed signs are destroyed. Low-lying escape routes are cut by rising water 3-5 hours before arrival of the hurricane center. Flooding near the coast destroys smaller structures with larger structures damaged by battering of floating debris. Terrain continuously lower than 5 feet above mean sea level may be flooded inland 8 miles or more. Evacuation of low-lying residences within several blocks of the shoreline may be required.

Category 4
More extensive curtain wall failures with some complete roof structure failures on small residences. Shrubs, trees, and all signs are blown down. Complete destruction of mobile homes. Extensive damage to doors and windows. Low-lying escape routes may be cut by rising water 3-5 hours before arrival of the hurricane center. Major damage to lower floors of structures near the shore. Terrain lower than 10 feet above sea level may be flooded requiring massive evacuation of residential areas as far inland as 6 miles.

Category 5
Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. All shrubs, trees, and signs blown down. Complete destruction of mobile homes. Severe and extensive window and door damage. Low-lying escape routes are cut by rising water 3-5 hours

before arrival of the hurricane center. Major damage to lower floors of all structures located less than 15 feet above sea level and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5-10 miles of the shoreline may be required.

Historic Impact of Hurricanes and Coastal Storms

Information on the extent of damages from hurricanes and tropical storms (Table A-13) was available only as a statewide estimate and no hurricane or tropical storm has had a direct impact on the Town of Rolesville since 2006.

Table A-13: Hurricanes and Tropical Storms Affecting Wake County

Date	Storm Name	Deaths and Injuries in NC		Damages in NC	
		Deaths	Injuries	Property	Crop
10/16/1954	Hazel	5.3	0.5	$1,360,000	N/A
9/4/1979	David	0.01	0	$50,000	$5,000
7/24/1985	Gloria	0	0	$7,692	N/A
7/12/1996	Bertha	0	0	N/A	N/A
9/05/1996	Fran	7	2	4,000,000,000	N/A
8/27/1998	Bonnie	0	0	N/A	$50,000,000
9/04/1999	Dennis	0	0	N/A	$3,000,000
9/15/1999	Floyd	0	0	$3,000,000,000	$500,000,000
9/17/2003	Isabel	1	0	$7,300,000	N/A
9/01/2006	Ernesto	0	0	N/A	N/A
Totals		**13.31**	**2.5**	**$7,008,717,692**	**$553,005,000**

Source: National Climatic Data Center, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms and SHELDUS (Spatial Hazard Events and Losses Database for the United States, http://go2.cla.sc.edu/hazard/db_registration.

Hazard Analysis – Hurricanes and Coastal Storms

Likelihood of Occurrence of Hurricanes and Coastal Storms

There have been a number of hurricanes (and tropical storms) whose impacts have been felt in Wake County. Hurricanes that have struck North Carolina in the last 50 years include Hazel in 1954, Connie, Diane and Ione all in 1955, Donna in 1960, Hugo in 1989, Emily in 1993, Opal in 1995, Bertha and Fran in 1996, Bonnie in 1998, and Dennis, Floyd in 1999, Isabel in 2003 and Ernesto in 2006. Because of the size of these storms (up to 400 miles wide), the Wake County area felt some impact (including torrential rains and high winds) from these storms. In addition to the above named hurricanes there have been smaller tropical storms that have also impacted Wake County. The probability of Wake County, including the Town of Rolesville, experiencing the effects of a hurricane, or tropical storm, can be classified as “likely”.

Likely Range of Impact of Hurricanes and Coastal Storms

Hurricanes and tropical storms are not localized events. The diminishment of the destructive force of a hurricane or tropical storm from one side of Wake County to the other would probably be negligible. The impact of the wind element of a hurricane or a tropical storm within the County would be fairly uniform among structures which were built using comparable construction methods and materials. The impact of the associated rainfall from a hurricane or tropical storm would primarily affect structures

and infrastructure in proximity to regulatory floodplains and secondary tributaries and creeks. The accumulation of windblown debris in public or private storm drainage inlets and drainage swales has the potential to cause minor flooding problems throughout the area. If a hurricane or tropical storm were to occur, the entire Wake County area, including the Town of Rolesville, would be subject to the effects of the storm, therefore the range of impact can be classified as "large".

Probable Level of Impact of Hurricanes and Coastal Storms

Property damage can result when the high winds of a hurricane or a tropical storm combine with saturated soils from extended heavy rains which may cause trees to be uprooted and fall onto nearby structures, or when windblown debris damages structures. Additionally, hurricanes and tropical storms generally include bands of severe thunderstorms, which may produce hail and spawn tornadoes. The probable level of impact of a hurricane or tropical storm can be classified as "limited".

Wake County/Town of Rolesville Hazard Index for Hurricanes and Coastal Storms

The hazard index for hurricane impacts in Wake County, including the Town of Rolesville, is "moderate" based on the probability of occurrence being "likely", the "large" area that would be impacted, and the probable "limited" damage impact. This hazard index indicates that hurricanes and coastal storms pose a relatively large, but infrequent threat. Since hurricanes and coastal storms are also significant contributors to flooding, there are opportunities for local hazard mitigation efforts to have a significant impact on exposure to future events.

4. Severe Storms and Tornadoes

4.1. Severe Storms (Thunderstorms, Hail and Lightning)

(Photo – Source: NC Department of Transportation

Severe thunderstorms can occur alone or in clusters, but affect relatively small areas compared to those affected by hurricanes or nor'easters. In eastern North Carolina, thunderstorms most frequently occur in the late afternoon or during the evening or night hours during the summer months. Summer thunderstorms involve lightning, strong winds, heavy rains and hail that can result in wildfires, localized wind damage and flash flooding.

According to the North Carolina State Climate Office, thunderstorms typically are 15 miles or less in diameter and last an average of 20 to 30 minutes. Downbursts and straight-line winds associated with thunderstorms can produce winds of 100-150 miles per hour - enough to flip large trucks and endanger airplane landings and takeoffs. The potential impact of thunderstorms, however, can be rated low due to the localized nature of the storms.

The National Weather Service considers a thunderstorm severe if it produces hail at least three-quarters of an inch in diameter, has winds of 58 miles per hour or greater or produces a tornado. Of the estimated 100,000 thunderstorms in the United States each year, only about 10% are classified as severe.

Lightning, a major threat during a thunderstorm, is responsible for more deaths each year in the United States than are tornadoes. Since lightning strikes are very unpredictable, the risk to individuals and property can be significant.

Historic Impact of Thunderstorms within the Town of Rolesville

Thunderstorm/high wind storm events and thunderstorm related events (lightning and hail) that have directly affected the Town of Rolesville are reported in Tables A-15, and A-16. Note: There were no specific records for lightning events in the Town of Rolesville. No thunderstorm with winds over 50 knots has been recorded in Rolesville since July, 11, 2007.

Table A-14: Thunderstorm/High Wind Data for the Town of Rolesville 1958 – 2007

Location	Date	Time	Magnitude (in knots)	Deaths	Injuries	Property Damages
Rolesville	5/1/1997	4:15 PM	50	0	0	0
Rolesville	8/18/2000	4:25 PM	50	0	0	0
Rolesville	11/11/2002	10:00 AM	50	0	0	0
Rolesville	4/03/2006	6:55 PM	50	0	0	0
Rolesville	5/14/2006	2:40 PM	50	0	0	0
Rolesville	6/23/2006	3:05 PM	50	0	0	0
Rolesville	7/27/2006	12:55 PM	50	0	0	0
Rolesville	7/11/2007	4:10 PM	50	0	0	0
Totals				**0**	**0**	**N/A**

Source: National Climatic Data Center, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms and SHELDUS (Spatial Hazard Events and Losses Database for the United States, http://go2.cla.sc.edu/hazard/db_registration.

Table A-15: Hail Storm Data for the Town of Rolesville 1958 – 2008

Location	Date	Time	Magnitude (in inches)
Rolesville	6/12/1995	4:50 PM	1.50
Rolesville	4/22/2006	12:05 PM	.88
Rolesville	5/14/2006	2:40 PM	1.75
Rolesville	5/20/2008	3:52 PM	1

Source: National Climatic Data Center, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms and SHELDUS (Spatial Hazard Events and Losses Database for the United States, http://go2.cla.sc.edu/hazard/db_registration.

Hazard Analysis – Thunderstorms

Likelihood of Occurrence of Thunderstorms

There are only four thunderstorm related event records for the Town of Rolesville. However, the likelihood of occurrence can be rated as "highly likely" due to the frequency of occurrence within Wake County.

Likely Range of Impact for Thunderstorms

The entire Rolesville planning jurisdiction is subject to the effects of a thunderstorm, including lightning and hail. Thunderstorms may be somewhat localized in relatively small bands or squalls, which may result in varying amounts of rainfall and wind being felt at different locations within the Town. The range of impact is classified as "small".

Probable Level of Impact for Thunderstorms

Although occurring frequently, severe thunderstorms typically have only a minor impact on the areas affected. The probable level of impact of severe thunderstorms, hail and lightning within the Town of Rolesville can be categorized as "negligible".

Town of Rolesville Hazard Index for Thunderstorms

The hazard index for severe thunderstorms within the Town of Rolesville is categorized as "moderate" based on a "highly likely" occurrence, "medium" range of impact, but "negligible" level of impact. This hazard index of "moderate" indicates that although thunderstorms definitely pose a regular threat within the Town of Rolesville, the impacts are not at the level that requires a concentration of local hazard mitigation efforts.

4. Tornadoes (Map A-1: Town of Rolesville Multi-Hazards Map) *Source: NOAA.*

Many times severe storms, such as thunderstorms and hurricanes, can produce concentrated windstorms called tornadoes. Tornadoes are violently rotating columns of air created where warm, moist air intersects with cold, dry air. Tornadoes have a much more localized impact than a hurricane or nor'easter and have been known to destroy one building while leaving a nearby building virtually unharmed.

Tornadoes can produce a path of destruction from 0.01 mile wide to greater than 1 mile wide but generally tornadoes are less than 0.6 mile in width. In terms of length, paths of destruction vary from a few hundred feet to several miles in length. The duration of a tornado is typically less than 30 minutes.

The destruction caused by tornadoes may range from light to severe depending on the intensity of the storm and the travel path. Typically, tornadoes cause the greatest damages to structures of light construction, such as residential homes. The Fujita-Pearson Scale for tornado strength is shown in Table A-17.

Table A-15: Fujita-Pearson Tornado Scale

F-Scale	Damage	Winds (mph)	Path Length (miles)	Mean Width (miles)
F0	Light	40-72	<1.0	<0.01
F1	Moderate	73-112	1.0-3.1	0.01-0.03
F2	Considerable	113-157	3.2-9.9	0.04-0.09
F3	Severe	158-206	10-31	0.1-0.3
F4	Devastating	207-260	32-99	0.32-0.99
F5	Incredible	261-318	100+	1.0+

Source: Local Hazard Mitigation Planning Manual, North Carolina Division of Emergency Management, 1998.

Tornadoes are most likely to occur during the spring and early summer months of March through June. Tornadoes during these months tend to be the strongest, resulting in the greatest amount of physical harm and property damage. Tornadoes can occur at any time of day but are mostly likely to form between the hours of 3 p.m. and 9 p.m.

Historic Impact of Tornadoes in Wake County/Town of Rolesville

North Carolina ranks 22nd out of the 50 states for frequency of tornadoes, 18th for number of tornado related deaths, 17th for injuries and 21st for cost of damages. Although tornadoes in North Carolina are typically less severe than in other parts of the country, the North Carolina

Division of Emergency Management has rated Wake County as a "high" risk for tornadoes (Local Hazard Mitigation Planning Manual, p. 86).

Twenty-eight tornadoes hit Wake County between 1950 and 2010. (Table A-18) Although there were no recorded tornado events within the Town of Rolesville, the history of tornadoes within the County indicates that the Town is at risk though a weak (sub F0) tornado struck north of the Town in March, 2011.

Table A-16: Tornado Data for Wake County 1950-2007

Location	Date	Time	Magnitude	Deaths	Injuries	Property Damages
Wake County	5/12/1950	5:00 PM	F0	0	0	0
Wake County	5/12/1950	5:00 PM	F1	0	0	0
Wake County	4/5/1952	12:45 AM	F2	0	0	25K
Wake County	3/18/1956	2:30 PM	F2	0	0	3K
Wake County	3/18/1956	2:30 AM	F1	0	1	25K
Wake County	11/2/1966	9:35 AM	F2	0	9	250K
Wake County	5/14/1967	4:30 PM	F0	0	0	0
Wake County	7/11/1967	1:25 PM	F1	0	0	25K
Wake County	5/28/1973	3:00 PM	F1	0	0	25K
Wake County	5/29/1973	2:00 PM	F0	0	0	25K
Wake County	12/31/1975	4:00 PM	F1	0	0	3K
Wake County	5/7/1977	2:50 AM	F0	0	0	3K
Wake County	2/11/1981	3:05 PM	F2	0	2	250K
Wake County	6/13/1982	2:10 AM	F1	1	0	25K
Wake County	6/16/1982	12:25 PM	F2	0	0	250K
Wake County	3/14/1986	3:55 PM	F1	0	0	25K
Wake County	3/26/1986	7:55 PM	F0	0	0	0
Wake County	11/28/1988	12:00 AM	F4	2	105	250M
Wake County	10/23/1990	2:18 AM	F1	0	0	0
Raleigh	3/27/1993	4:05 PM	F0	0	0	0
Wendell	4/15/1996	5:08 PM	F0	0	0	10K
Wendell	4/15/1996	5:25 PM	F1	0	26	3.0M
Cary	7/12/1996	1:25 PM	F0	0	0	50K
Holly Springs	3/20/1998	6:15 PM	F0	0	0	0
Garner	3/20/1998	6:40 PM	F2	0	2	650K
Raleigh	3/20/1998	6:45 PM	F0	0	0	15K
Cary	6/1/2001	1:00 PM	F0	0	0	0
Apex	9/27/2004	6:30 PM	F0	0	0	0
Garner	9/14/2007	6:25 PM	F0	0	0	0
Totals				**3**	**145**	**$254.7M**

Source: National Climatic Data Center, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms and SHELDUS (Spatial Hazard Events and Losses Database for the United States, http://go2.cla.sc.edu/hazard/db_registration.

Hazard Analysis – Tornadoes

Likelihood of Occurrence of Tornadoes

The National Climatic Data Center indicates that there have been 27 tornadoes in Wake County since 1950. Most of the Wake County tornadoes have been fairly weak events (F0 and F1 on the Fujita-Pearson Tornado Scale); however, there have been six F2 tornadoes since 1950. The most destructive tornado in Wake County history occurred

when Raleigh experienced a severe F4 tornado in late November 1988. Thus, the likelihood of a tornado in the Rolesville area is rated “highly likely”.

Likely Range of Impact for Tornadoes
A tornado event would have a localized effect over a “small” area.

Probable Level of Impact for Tornadoes
The probable level of impact of tornadoes within the Town of Rolesville can be categorized as “negligible” based on the history of tornado occurrences in the Wake County area.

Town of Rolesville Hazard Index for Tornadoes
The hazard index for tornadoes for the Town of Rolesville is categorized as “low” based on a “highly likely” occurrence, “small” range of impact, and “negligible” level of impact. This hazard index of “low” indicates that although tornadoes pose a threat, the overall impact of tornadoes is expected to be minor.

5. Wildfires (Map A-1: Town of Rolesville Multi-Hazards Map)

Wildfires occur in North Carolina during the dry spring and summer months. The potential for wildfires depends upon recent climate conditions, surface fuel characteristics, and fire behavior. Wildfires can destroy precious natural resources and forestry essential to the survival of wildlife. There are four types of wildfires as described in Table A-19.
Lake Benson Park Trail, February 1997
Source: Town of Garner

Table A-17: Types of Wildfires

Type	Description	Control
Ground	Burns in natural litter, duff (decayed organic matter), roots, or high organic soils.	Once started, difficult to control. Fire may rekindle.
Surface	Burns in grasses, low shrubs, and lower branches of trees.	May move rapidly. Ease of control depends upon fuel involved.
Crown	Burns in tops of trees.	Difficult to control; wind plays important role.
Spotting	Produced by crown fires; wind/topography conditions. Large burning embers thrown ahead of main fire.	Makes fire very difficult to control.

Source: National Weather Service, www.seawfo.noaa.gov/fire/olm/firetype.htm

In recent years, increased residential development has been occurring along the urban/rural interface where homes built in or near forests become susceptible to wildfire damage. These buildings are at great risk since wildfires often begin unnoticed and spread rapidly igniting brush, trees and buildings. Potential wildfire areas (defined as areas with forest cover and greater than 50 acres in size) are indicated on Map A-1: Town of Rolesville Multi-Hazards Map.

State forestry personnel have estimated that Hurricanes Fran and Floyd together multiplied the amount of forest fire fuel (pine needles, cones, twigs and damaged trees

on the ground) by more than three times – increasing potential wildfire fuel from five tons to sixteen tons per acre in central and eastern North Carolina. In areas where downed or damaged trees were not removed, excess wildfire fuel has greatly increased the likelihood of uncontrollable wildfires due to increased fire intensity and blocked fire roads.

Historic Impact of Wildfires in Wake County

In the past several years, numerous wildfires were reported in Wake County (Table A-20). The North Carolina Division of Emergency Management has rated Wake County as a "moderate" risk for wildfires (Local Hazard Mitigation Planning Manual, p. 86).

The number of fires and acres burned per year varied widely over the reporting period. However, the potential for significant property damage is greatest for those structures in close proximity to woodlands as wind direction and velocity changes can quickly imperial properties close to wildfire fuels.

Hazard Analysis – Wildfires

*Note: Wildfire data is reported by the NC Division of Forest Resources only at the county level, thus no specific information was available for the Town of Rolesville.

Likelihood of Occurrence of Wildfires in Wake County/Town of Rolesville

Between 2002 and 2007, there were on average 21 wildfires per year in Wake County. The likelihood of occurrence of a wildfire can be classified as "highly likely". Potential wildfire areas (areas greater than 50 acres in size and with forest cover) are shown on Map A-1 Town of Rolesville Multi-Hazards Map.

Likely Range of Impact for Wildfires in Wake County/Town of Rolesville

When wildfires do occur they typically impact a relatively small area of land. Since 1980, wildfires have burned on average 166 acres per year. The range of impact can be classified as "small".

Probable Level of Impact for Wildfires in Wake County/Town of Rolesville

Wildfires have a very limited impact on the community so the level of impact of wildfires can be classified as "negligible" for Wake County.

Wake County/Town of Rolesville Hazard Index for Wildfires

The hazard index for wildfires in Wake County/Town of Rolesville is categorized as "moderate" based on a "highly likely" occurrence, but "small" range of impact, and "negligible" level of impact. This hazard index of "moderate" indicates that the threat of wildfires does not warrant significant additional hazard mitigation activities at the local level beyond those carried out by the State of North Carolina.

Table A-18: Wildfires by Cause for Wake County 2007 & 5 Year Average

Cause	2008	5 Year Average
Lightning	1	1
Campfire	1	1
Smoking	0	2
Debris Burning	1	4
Incendiary	4	5
Machine Use	2	2
Railroad	0	0
Children	1	4
Miscellaneous	3	2
Total	**13**	**21**

6. Winter Storms and Freezes

6.1 Nor'easters

Nor'easters are similar to hurricanes in respect to their effects. However, nor'easters, unlike hurricanes, are extra-tropical storms that derive their strength from horizontal gradients in temperature - they form as a result of a drop in temperature. Nor'easters affect the coast in a similar fashion to hurricanes as they produce high winds and heavy surf.

Nor'easters are usually more diffuse and less intense than hurricanes resulting in less significant damage. Nor'easters occur more frequently, cover larger land areas and those storms occurring during winter months may also produce ice hazards and effects similar to those of a severe winter storm.

The frequency of major nor'easters (Class 4 or 5) has increased in recent years. From 1987 to 1993, at least one class 4 or 5 storm occurred each year along the Atlantic seaboard of the United States. This high frequency is a situation duplicated only once in the last 50 years (State Climate Office of North Carolina, North Carolina State University.) Nor'easters are rated by the Dolan-Davis Intensity Scale shown in Table A-21.

Table A-19: Dolan-Davis Nor'easter Intensity Scale (1993)

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage
1 (Weak)	Minor changes	None	No	No
2 (Moderate)	Modest; mostly to lower beach	Minor	No	Modest
3 (Significant)	Erosion extends across beach	Can be significant	No	Loss of many structures at local level
4 (Severe)	Severe beach erosion and recession	Severe dune erosion or destruction	On low beaches	Loss of structures at community-scale

5 (Extreme)	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive losses on a regional-scale

Source: Local Hazard Mitigation Planning Manual, NC Division of Emergency Management, 1998.

Historic Impact of Nor'easters in Wake County

Nor'easters have certainly affected the Town of Rolesville area, however; the National Climatic Data Center does not list a history of those events. The North Carolina Division of Emergency Management has rated Wake County as a "low" risk for nor'easters (Local Hazard Mitigation Planning Manual, p. 86).

6.2 Winter Storms

Severe winter weather is typically associated with much colder climates; however, in some instances winter storms do occur in the warmer climate of North Carolina. On occasion, the Town of Rolesville has had moderate winter weather as a result of a nor'easter originating in the Gulf Stream and producing frozen precipitation. Winter storms can paralyze a community by shutting down normal day-to-day operations. Winter storms produce an accumulation of snow and ice on trees and utility lines resulting in loss of electricity and blocked transportation routes. Frequently, especially in rural areas, loss of electric power means loss of heat for residential customers, which poses an immediate threat to human life. Because of the rare occurrence of these events, central and eastern North Carolina communities are often not prepared because they cannot afford to purchase expensive road and debris clearing equipment for these relatively rare events.

Table A-20: Historic Snow and Ice Events for Wake County, NC (1950 – 2010)

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Statewide	03/12/1993	1600	Winter Storm	N/A	2	10	50.0M	0
2 Northern And Central	01/03/1994	1800	Heavy Snow	N/A	0	0	0	0
3 Northern Interior And	02/10/1994	1000	Ice Storm	N/A	0	0	0	0
4 NCZ041	01/06/1996	01:00 PM	Winter Storm	N/A	0	0	0	0
5 NCZ041	01/11/1996	10:00 PM	Ice Storm	N/A	0	0	0	0
6 NCZ041	02/02/1996	02:00 AM	Ice Storm	N/A	0	0	0	0
7 NCZ041	02/16/1996	06:00 AM	Heavy Snow	N/A	0	0	0	0
8 NCZ027>028 - 041>043 - 073>077 - 083>084 - 086	01/19/1998	06:00 AM	Heavy Snow	N/A	0	0	0	0

9 NCZ007>011 - 021>028 - 038>043 - 073>078 - 083>086 - 088>089	12/23/1998	02:00 PM	Ice Storm	N/A	0	0	0	0
10 NCZ007>011 - 021>028 - 038>043 - 073>078 - 083>086 - 088>089	01/18/2000	02:00 AM	Winter Storm	N/A	0	0	0	0
11 NCZ007>011 - 021>024 - 026>028 - 038>043 - 076>077 - 089	01/20/2000	12:00 AM	Winter Storm	N/A	0	0	0	0
12 NCZ007>011 - 021>028 - 038>043 - 073>078 - 083>086 - 088>089	01/22/2000	06:00 PM	Winter Storm	N/A	0	0	0	0
13 NCZ007>011 - 021>028 - 038>043 - 073>078 - 083>086 - 088>089	01/24/2000	05:00 AM	Winter Storm	N/A	0	0	0	0
14 NCZ007>011 - 021>028 - 038>043 - 073>077 - 083>086 - 088>089	01/28/2000	10:00 AM	Winter Storm	N/A	0	0	0	0
15 NCZ007>011 - 021>028 - 038>043 - 073>077 - 083	11/19/2000	11:00 AM	Heavy Snow	N/A	0	0	0	0
16 NCZ007>011 - 021>028 - 038>043 - 073>078 - 083>086 - 088>089	01/03/2002	12:00 AM	Winter Storm	N/A	0	0	0	0
17 NCZ007>011 - 021>028 - 038>043 - 073>077 - 083>084	12/04/2002	03:00 PM	Winter Storm	N/A	0	0	0	0
18 NCZ007>011 - 021>027 - 038>043 - 073>077 - 083>084 - 086	02/16/2003	12:00 PM	Winter Storm	N/A	0	0	0	0
19 NCZ007>009 - 021>025 - 038>041	02/27/2003	12:00 AM	Winter Storm	N/A	0	0	0	0
20 NCZ007>011 - 021>028 - 038>043 - 073>078 - 083>086 - 088>089	01/26/2004	04:30 AM	Winter Storm	N/A	0	0	0	0
21 NCZ007>011 - 021>027 - 038>039 - 041	02/15/2004	11:00 PM	Winter Storm	N/A	0	0	0	0
22 NCZ007 - 021>028 - 038>039 - 041>043 - 073>078 - 083>086 -	02/26/2004	09:00 AM	Winter Storm	N/A	0	0	0	0

088>089								
23 NCZ011 - 026>028 - 041>043 - 075>078 - 084>086 - 088>089	12/26/2004	01:00 AM	Winter Storm	N/A	0	0	0	0
24 NCZ007>010 - 021>026 - 038>042 - 073	01/18/2007	05:00 AM	Winter Weather	N/A	0	0	0K	0K
25 NCZ038 - 041 - 073 - 075 - 083 - 088	02/01/2007	08:00 AM	Winter Storm	N/A	0	0	0K	0K
26 NCZ038 - 041 - 073 - 075 - 083 - 088	02/01/2007	08:00 AM	Winter Weather	N/A	0	0	0K	0K
27 NCZ007 - 021>025 - 038>042 - 073>077 - 083>086 - 088	01/17/2008	02:00 AM	Winter Weather	N/A	0	0	0K	0K
28 NCZ009 - 039 - 041 - 043 - 073>076 - 084	01/20/2009	00:00 AM	Winter Storm	N/A	0	0	0K	0K
29 NCZ008>010 - 025>026 - 041	03/02/2009	01:00 AM	Winter Storm	N/A	0	0	0K	0K
30 NCZ007 - 010 - 021>024 - 041>043 - 078 - 083	01/29/2010	21:00 PM	Winter Storm	N/A	0	0	0K	0K
31 NCZ007>011 - 024 - 026>027 - 041 - 043 - 078 - 088	02/12/2010	20:00 PM	Winter Storm	N/A	0	0	0K	0K
32 NCZ007>011 - 024 - 026>027 - 041 - 043 - 078 - 088	02/12/2010	20:00 PM	Winter Weather	N/A	0	0	0K	0K
33 NCZ007 - 011 - 021>028 - 038>043 - 073>078 - 088	03/02/2010	15:00 PM	Winter Storm	N/A	0	0	0K	0K
34 NCZ007 - 011 - 021>028 - 038>043 - 073>078 - 088	03/02/2010	15:00 PM	Winter Weather	N/A	0	0	0K	0K
35 NCZ007>009 - 025>026 - 041 - 076 - 088	12/16/2010	03:00 AM	Winter Weather	N/A	0	0	0K	0K
36 NCZ026 - 041	12/25/2010	19:00 PM	Winter Storm	N/A	0	0	0K	0K
				TOTALS:	2	10	50.000M	0

Source: National Climatic Data Center.

Historic Impact of Severe Winter Storms in Wake County

The North Carolina Division of Emergency Management has rated Wake County as a "moderate" risk for severe winter storms (Local Hazard Mitigation Planning Manual, p. 86).

Hazard Analysis – Winter Storms and Freezes

Likelihood of Occurrence of Severe Winter Storms within the Town of Rolesville

North Carolina averages two severe winter storms per year in the Piedmont area of the State. Even though the Town of Rolesville does not have any specific data indicating the occurrence of severe winter storms, the likelihood of occurrence of a severe winter storm can be classified as "highly likely".

Likely Range of Impact for Severe Winter Storms within the Town of Rolesville

When severe winter storms do occur they typically impact a relatively large area or region of the State, thus the range of impact can be classified as "large".

Likely Range of Impact for Severe Winter Storms within the Town of Rolesville

Severe winter storms can have a tremendous impact on communities within the State, but they do not typically result in more than "limited" impact.

Town of Rolesville Hazard Index for Severe Winter Storms

The hazard index for severe winter storms for the Town of Rolesville is categorized as "high" based on a "highly likely" occurrence, "large" range of impact, and "limited" level of impact. This hazard index of "high" indicates that the severe winter storms are a serious threat that should be addressed by local hazard mitigation initiatives where possible. Because of the regional impact of severe winter storms, however, many initiatives are more appropriately addressed and coordinated by the State and utility providers, e.g., electric, phone, and cable companies.

D. NC Emergency Management Hazard Analysis for Wake County/Town of Rolesville

The North Carolina Local Hazard Mitigation Planning Manual, published by the NC Division of Emergency Management, was used as another reference source for assessing natural hazards. Table A-22 shows the State's summary assessment for Wake County for the nine natural hazards identified in the Local Hazard Mitigation Planning Manual. (Note: Information in the manual was presented only on the county level.)

Table A-21: Natural Hazard Summary Assessment for Wake County

Natural Hazard[a]	Vulnerability of Wake County[b]
Hurricane	Low
Flood	Moderate
Tornado	High
Nor'easter	Low
Thunderstorm[c]	Moderate
Drought	Moderate
Heat Wave	Moderate
Severe Winter Storm	Moderate
Wildfire	Moderate

Source: Local Hazard Mitigation Planning Manual, NCDEM, 1998, p. 84-5.

[a] The "Local Hazard Mitigation Planning Manual" does not rate the following hazards for Wake County - coastal erosion, levee failures, coastal storms, tsunamis, and volcanoes.
[b] The North Carolina Division of Emergency Management Methodology: Each of the one hundred counties in North Carolina was categorized into one of three levels of natural hazard likelihood – "Low", "Moderate", or "High" for eight natural hazards. Some assignments were made, in part, using the Climate Division (formulated by the National Climatic Data Center - Guttman and Quayle, 1995) to which each county was assigned. The Climate Division number for Wake County is 8. For additional information on how ratings were developed, see Local Hazard Mitigation Planning Manual, North Carolina Division of Emergency Management, November 1998.
[c]Thunderstorms were not rated in the Local Hazard Mitigation Planning Manual. For the purposes of this report, thunderstorms were rated moderate.

The manual also estimated the potential impact of various natural hazards for Wake County as shown in Table A-21. This information from the Local Hazard Mitigation Planning Manual was considered as part of the analysis process.

Table A-22: Natural Hazards–Potential Impact Data for Wake County

Natural Hazard	Range	Wake County
Frequency of All Hurricanes, 1900-96	Saffir-Simpson Class 1-5	0
Frequency of Minor Hurricanes, 1900-96	Saffir-Simpson Class 1-2	0
Frequency of Major Hurricanes, 1900-96	Saffir-Simpson Class 3-5	0
Nor'easter Vulnerability	1 = some direct vulnerability	0
Frequency of Tornadoes, 1953-1995	Number of tornadoes	16
Extreme 1-day snowfall	In inches	10.1
Cold Air Damming Vulnerability	1 = some vulnerability	1
Wildfires, 1950-1993	Low = 1, Mod. =2, High = 3	2
Number of Acres Burned	Low = 1, Mod. =2, High = 3	1

Source: Local Hazard Mitigation Planning Manual, NCDEM, 1998, pp. 88-91.

E. Town of Rolesville Composite Hazard Index

Certain parts of the Town of Rolesville planning jurisdiction, such as floodplains, are more prone to hazards than other areas. In addition, certain types of hazards are likely to produce only localized effects while others have wide spread effects. Some natural hazards have extraordinary impacts but occur infrequently. Other hazards occur annually or several times a decade, but cause little damage.

The total potential impact of each type of hazard has been projected using a combination of likely strength of the event, the size of the area(s) affected, and the density of human activity within the likely path of the hazard. Table A-24 gives natural hazards a "composite hazard index" rating based on the combination of three factors – likelihood of occurrence, likely range of impact, and probable level of impact. (Note: An explanation of the terms and the ranking system are included in Tables A-1 through A-4 at the beginning of Appendix A.)

Table A-23: Town of Rolesville Composite Hazard Index

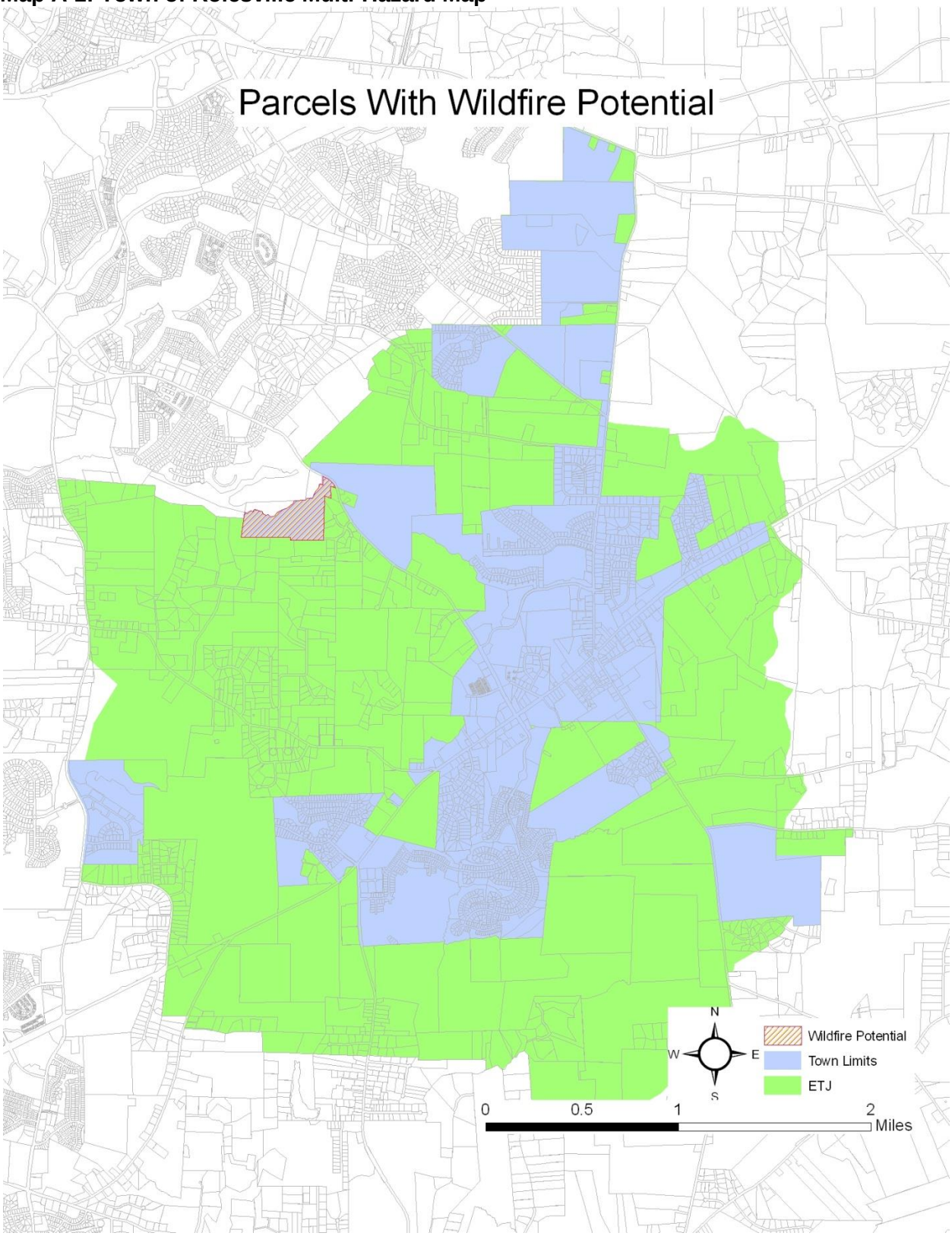
Hazard Type	Likelihood of Occurrence	Likely Range of Impact	Probable Level of Impact	Hazard Index (combined ranking)
Droughts and Heat Waves	(3) Likely	(3) Large	(1) Negligible	**(7) Moderate**
Floods	(3) Likely	(1) Small	(2) Limited	**(6) Moderate**
Hurricanes and Coastal	(3)	(3)	(2)	**(8)**

Storms	Likely	Large	Limited	**Moderate**
Severe Storms and Tornadoes	(4) Highly Likely	(1) Small	(1) Negligible	**(6) Moderate**
Wildfires	(4) Highly Likely	(1) Small	(1) Negligible	**(6) Moderate**
Winter Storms and Freezes	(4) Highly Likely	(3) Large	(2) Limited	**(9) High**

The Town of Rolesville Composite Hazard Index (Table A-23) addresses only the six hazards that received a "moderate" or "high" rating as these hazards pose the greatest potential risk to persons and property. Three of these hazards – droughts and heat waves, hurricanes and coastal storms, and winter storms and freezes – typically have a regional impact; however, the impact of droughts and heat waves on an urbanized area such as the Town of Rolesville would be considered negligible as compared to rural, agrarian communities. For purposes of calculating vulnerability, the community is assumed to have 100% exposure to hurricanes and coastal storms and to winter storms and freezes (see Appendix B Vulnerability Assessment for more detail).

The other three hazards – floods, severe storms and tornadoes, and wildfires – typically have a much more limited area of impact. Floods only impact flood hazard areas thus exposure is limited to development within these identified and mapped areas of Town. For severe storms and tornadoes and for wildfires, the community is assumed to have an approximate 10% exposure (see Appendix B Vulnerability Assessment for more detailed information).

Map A-1: Town of Rolesville Multi-Hazard Map



Appendix B: Assessment of Vulnerability

A. Introduction

The Town of Rolesville Composite Hazard Index (Table A-24 in Appendix A) outlines the six hazards rated "moderate" or "high" for potential threat to persons and property. Three of these hazards – droughts and heat waves, hurricanes and coastal storms, and winter storms and freezes – typically have a regional impact; however, the impact of droughts and heat waves on an urbanized area such as the Town of Rolesville would be considered negligible as compared to rural, agrarian communities. Based on hazard event history, it is estimated that the Town of Rolesville has a maximum 100% exposure to hurricanes and coastal storms and to winter storms and freezes. A 100% exposure means that all structures both public and private within the Town could possibly be impacted by these types of hazard events.

The other three hazards – floods, severe storms and tornadoes, and wildfires – typically have a much more limited area of impact. Floods only impact flood hazard areas thus exposure is limited to development within these identified and mapped areas of Town. For severe storms and tornadoes and for wildfires, it is estimated that the Town of Rolesville has a maximum 10% exposure, i.e., 10% or less of all structures within the Town could be impacted by these types of hazard events. This information from Appendix A will be used in this section to estimate a dollar amount of exposure to these hazards.

B. Community Description (Map B-1: Town of Rolesville Zoning Map)

Rolesville, in the northeast corner of Wake County, is part of the Raleigh-Durham-Chapel Hill Metropolitan Statistical Area, known locally as the Research Triangle. The Research Triangle is centrally located between the coast and mountains of North Carolina and has experienced rapid growth in the past few decades.

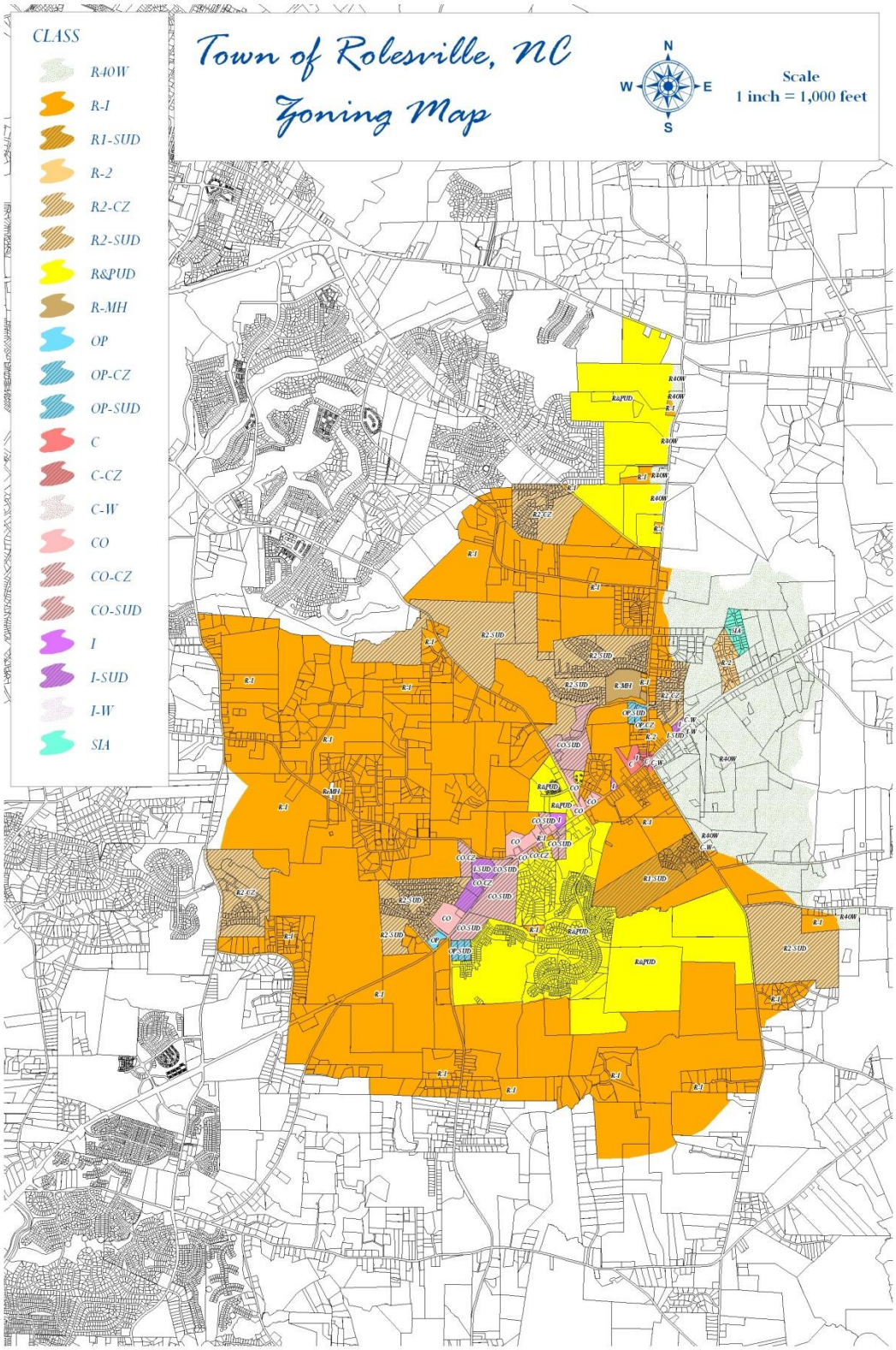
Named for its founder William Roles, the Town of Rolesville was incorporated in 1837 and is the second oldest town in Wake County. Located within a mile of both the capital city of Raleigh to the southwest and the Town of Wake Forest to the west, Rolesville is poised to reap both the benefits and the potential problems of rapid development.

The Town of Rolesville currently incorporates 2,542 acres and has an extraterritorial jurisdiction of 2,971 acres for a total planning jurisdiction of 5,513 acres (8.61 square miles). As a community of Wake County, the Town also has a designated urban growth area, which while still currently under Wake County planning jurisdiction, is identified as a future growth area for the Town.

Between 2000 and 2009 the population of Rolesville grew from 907 persons to 2,873 – an increase of almost 32%. Being on the edge of a rising growth curve, Rolesville is in an ideal position to minimize risk in the future through foresighted planning today.

The Town of Rolesville is served by a number of roads that create a convenient transportation network connecting the Town with other parts of Wake County and the larger Triangle region. US 401/Main Street, which bisects the town north to south, is the primary thoroughfare. Passing through Rolesville, US 401 is a two-lane highway but just south of the community, US 401 is a four-lane, limited-access, median-divided highway connecting the Town to and through the City of Raleigh. Other highways serving the area include NC 96 and NC 98, both within a 3-mile buffer of central Rolesville. Interstate 540 and US Highway 64 pass within a 10-mile buffer. Interstate 40, a major east-west route, is within a 15-mile buffer.

Map B-1: Town of Rolesville Zoning Map



Major Employers and Demographics

The only major employer located within the Town of Rolesville is Pine Glo that employs approximately 50 persons. The economy of the Town of Rolesville depends largely on the management or professional sector and sales and office occupations sector which in the 2000 Census (Table B-1) accounted for 60.2% of the total work force. The average travel time to work in the Town of Rolesville is 33.1 minutes.

Of the 582 people above the age of 25, 13.1% of The Town of Rolesville's residents have less than a high school education. 25.1% of all residents of the Town of Rolesville are college graduates. The median age of residents in 2000 was 36.8 years of age with 71.9% of the population above the age of 21.

Table B-1: Town of Rolesville Demographics

Economic		
Median Household Income		$46.838
Average Household Size		2.57
Percent of Individuals Below Poverty Level		12.5 %
Occupation	**People**	**Percent**
Management, professional, etc.	134	30.0 %
Service related	63	14.1 %
Sales and office	135	30.2 %
Farming, fishing, and forestry	-	-
Construction, extraction, and maintenance	64	14.3 %
Production, transportation, material moving	51	11.4 %
Employment	**People**	**Percent**
Employed	447	66.8 %
Unemployed	13	1.9 %
Not in labor force	209	31.2 %
Social		
Level of Educational Attainment	**People**	**Percent**
Less than 9th grade	25	4.3 %
9th – 12th (no diploma)	51	8.8 %
High School Diploma (includes GED)	206	35.4 %
Some college, no degree	125	21.5 %
Associate degree	53	9.1 %
Bachelor's degree	93	16.0 %
Graduate or professional degree	29	5.0 %
Housing		
Selected Characteristics	**People**	**Percent**
Lacking complete plumbing facilities	-	-
Lacking complete kitchen facilities	-	-
No phone service	8	2.3 %

Source: 2000 US Census.

Land Suitability

Gently rolling hills characterize the community landscape. A number of small streams in the area feed into the Neuse River as Rolesville rest on the northeastern boundary of the Upper Neuse Watershed. The 100-year floodplains of Sanford Creek to the west and Cedar Fork to the east both only slightly protrude into the Town's planning jurisdiction.

Water and Wastewater

By merger agreement, public water and sewer services are provided by the City of Raleigh. The agreement provides for a 375,000 gallon per day capacity through the year 2006. The Town is currently averaging about 110,000 gallons per day. In 2007, the agreement provided for up to 4% annual growth through 2015.

Developed and Undeveloped Areas (Map B-1 Town of Rolesville Zoning Map)

The majority of developed land in the Town of Rolesville consists of single-family residential development. Mobile/manufactured homes, either on single lots or within parks, compose about 17% of the residential inventory. Evergreen Mobile Home Estates, just off West Young Street, contains the largest concentration of mobile/manufactured home units. Other mobile/manufactured homes are primarily located along the US 401 corridor. In addition to the small downtown business district there is a new commercial shopping center just south of downtown on the US 401 corridor.

From 2004 to January 2010, real estate improvements within the Town of Rolesville accounted for almost $181 million in tax value (Table B-2). The total value of land, buildings, and other improvements within the corporate limits was $245,203,569 in tax value. Both real estate improvements and land (tree damage, soil erosion, etc.) are exposed to possible damage from future natural hazardous.

Most of the planning area outside of the incorporated town limits remains in very low density single-family or agricultural and forestry use. The Town expects that the recent rate of population growth will increase more rapidly in the coming years. As the currently undeveloped areas begin to be developed, the Town has planned for sensitive environmental areas; riparian buffers have been placed on selected creeks to protect them from inappropriate development (see Appendix C Community Capability).

Since flood hazard areas are located only on the far eastern and western fringes of the Town's planning jurisdiction, the Town does not expect to encounter flood hazard issues in the immediate future even with expected rapid population growth. However, the Town has adopted and does enforce a flood damage prevention ordinance to help ensure that any development proposed for these sensitive areas will be built according to ordinance regulations. The Town also has adopted floodplain protection regulations that should ease the impact of stormwater runoff in areas susceptible to floods.

Table B-2: Value of Developed Facilities and Undeveloped Land – Town of Rolesville

ROLESVILLE COMMERCIAL			ROLESVILLE RESIDENTIAL	
Commercial	56,937,450		ACWIMP	630,476
Industrial	2,765,962		AC>10HS	
AG Farm	4,102,580		Apt	
Historic	165,553		Mfg Home	80,788
Cemetery			Condominium	
Retirement			Residential	293,463,430
Leased			Auto	29,590,082
Part Exe	1,197,092		Personal Property	1,553,967
Mobile Home Park	1,085,480		Vacant Land	47,027,709
Golf Course			Excluded Value	(679,120)
Water System				
For Farm	3,360			
Hor Farm				
Defer Value	(3,357,849)			
Auto	118,835			
Comm Personal	6,337,132			
Public Service	3,173,156			
Vacant Land	17,115,461			
TOTAL COMMERCIAL	89,644,212		**TOTAL RESIDENTIAL**	371,667,332
	0.19			0.81
TOTAL COMMERCIAL & RESIDENTIAL VALUE $ 461,311,544				

Source: Wake County Revenue Department, July 2003.
[1] Values of January 27, 2009 (appraisal year)

Housing Growth

As shown in Table B-3, the 2000 Census for the Town of Rolesville identified a total of 383 housing units; 64 (16.7%) of these units were mobile/manufactured homes. As a general rule, mobile/manufactured homes are more susceptible than site-built homes to damages by natural hazards, especially high wind damages. Over 46% of the total housing units within the Town have been built since 1980 indicating the impact of recent population growth trends.

Table B-3: 2000 Census of Housing Units & Year Built – Town of Rolesville

Types of Housing Units		
Type of Unit	**Number of Units**	**% Total Units**
Single-family	294	76.8%
Multi-family	25	6.5%
Manufactured Homes	64	16.7%
Boat, RV, Van	0	0%
Total Units	**383**	**100%**

Housing Units by Year Built		
Year Built	**Number of Units**	**% Total Units**
1959 or earlier	85	22.2%
1960 - 1979	121	31.6%
1980 - 1989	49	12.8%
1990 - 2000	128	33.4%
Total Units	**383**	**100%**

Source: Census 2000

Table B-4 focuses on single-family units, the number of dwellings and tax values. The table demonstrates the dramatic increase in both land and building values through the selected time period.

Table B-4a: New Single Family Dwellings – Town of Rolesville (1992-2003)

Year Built	Number of Dwellings	Building Value	Total Value[1]
1992	2	$320,183	$363,093
1993	2	$328,346	$407,166
1994	10	$1,406,163	$1,678,163
1995	18	$2,465,283	$2,957,283
1996	14	$1,886,609	$2,223,009
1997	5	$696,941	$830,941
1998	12	$1,596,036	$1,932,036
1999	25	$3,139,827	$3,739,837
2000	25	$3,502,739	$4,204,739
2001	15	$2,094,339	$2,564,339
2002	51	$6,422,034	$7,826,034
2003	8	$304,600	$498,600
Totals	**187**	**$24,163,100**	**$29,225,240**

Source: Wake County Revenue Department, July 2003.
[1] Values are as of January 1, 2000 (Reappraisal Year).

Table B-4b: New Single Family Dwellings – Town of Rolesville (2004-2010)

Year Built	Number of Dwellings	Improvement Value
2004	84	$11,136,298
2005	198	$33,716,000
2006	210	$44,734,500
2007	195	$44,508,455
2008	94	$20,170,000
2009	25	$5,346,000
2010	49	$10,397,456
Totals	**855**	**$170,008,709**

Source: Town of Rolesville Planning Department, March 2011.

C. Critical Public Facilities

Critical public facilities are those facilities that are essential to the health, safety, and viability of the community. Critical facilities include public buildings, public infrastructure (roads, highways, bridges, water and sewer facilities*) and private utility services, e.g., electric, phone and cable, without which residents and businesses could not survive for extended periods of time. Certain facilities are critical to the response and recovery efforts in the wake of a disaster resulting from a natural or technological hazard. These include fire and rescue facilities, hospitals, major transportation facilities, communication facilities, and public water and sewer infrastructure.

The inventory of critical public facilities within the Town of Rolesville planning jurisdiction is shown in Table B-5 while other privately-owned or semi-public critical facilities and essential and supportive public facilities are listed below Table B-5. All facility locations are shown on Map B-2**.** The ability to protect these facilities from damage from a future natural hazard event is vital to the welfare of the citizens of the Town.

Rationale for Designating a Facility as Critical

Facilities within the Town of Rolesville have been divided into three categories of importance for hazard mitigation:

1. Critical Facilities – publicly-owned facilities that are absolutely necessary for response and recovery efforts during and after a disaster. This category includes all town-owned facilities that must either remain in operation without interruption or should be operational within 24 hours of an emergency (Table B-5). Other critical facilities that are not owned or operated by the Town are shown below Table B-5.
2. Essential – facilities that are essential for normal community functions and that should be back in service within 72 hours following a disaster.
3. Supportive – facilities/services that are typically available to the public but which can be closed for a week or more following a disaster without undue harm to public health and safety.

*(Note: Underground public water and sewer lines are generally not considered vulnerable to the types of hazards that could impact the Town of Rolesville with the exception that underground distribution and collection lines could be impacted by erosion associated with flooding events. Due to the very limited nature of this potential impact, underground lines are not included in the list of critical public facilities.

The Town of Rolesville has merged water and sewer systems with the City of Raleigh, which is responsible for operation and maintenance of public water and sewer facilities/infrastructure. A water booster station and a small sewer pump station are included in the critical facilities/infrastructure list (Table B-5).

Major roads, highways and bridges within the Town of Rolesville are owned and operated by the State of North Carolina and the Federal Highway System. Since the Town is not responsible for the operation and maintenance of these facilities, they are not included in vulnerability calculations.)

Table B-5: Critical Public Facilities/Public Infrastructure – Town of Rolesville

Critical Facility	Location	Function	Size (in sq. ft.)	Importance	Buildings Assessed Value
Fire Stations					
Fire Station	104 E. Young St	Fire Department	11,000	Critical	$831,242
Emergency Medical Services					
Emergency Medical Station (County building)	204 E. Young St.	Emergency Medical Services	3,200	Critical	$478,500
Police Stations					
Police Station	204 Southtown Cir.	Police Department	8,000	Critical	$150,000
Public Infrastructure					
Water Booster Station	Bowling Street	Public Water	N/A	Critical	$125,000
Sewer Pump Station	Averett at Jones Dairy	Public Sewer	N/A	Critical	$50,000
Water Tower	730 South Main St.	Public Water	N/A	Critical	$750,000

Source: Wake County GIS, Town of Rolesville.

Other Facilities

State/Federally-Owned Critical Facilities

Transportation Services

- US-401
- NC-96
- NC-98

US Post Office

Other Facilities

Essential

- Town Hall

Other Facilities

Supportive

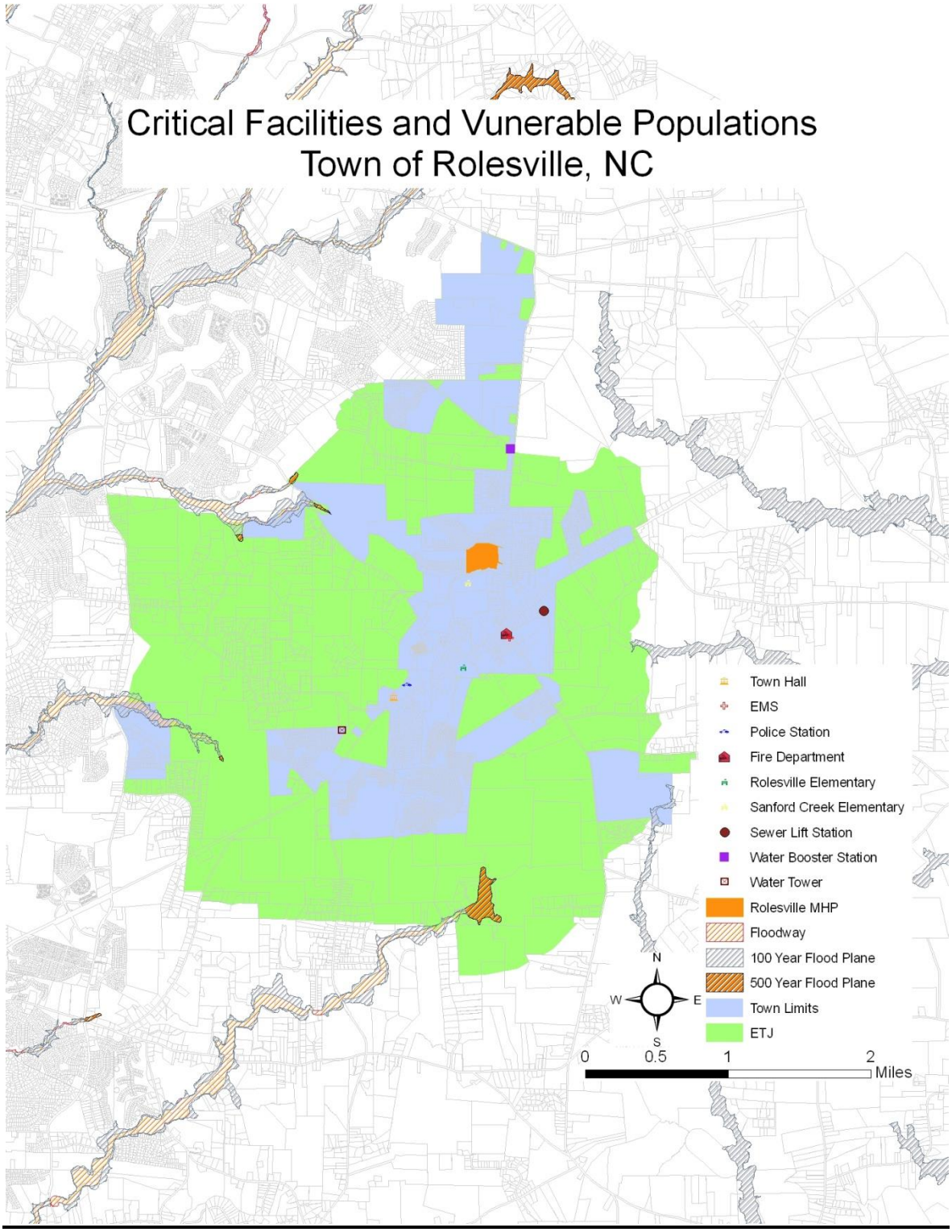
Specific Care Providers

- Rhymes & Reasons

Pubic Schools

- Rolesville Elementary
- Sanford Creek Elementary

Insert Map B-2: Town of Rolesville Critical Facilities/Vulnerable Populations Map



D. Description of All-Hazards Exposure (Map B-2: Town of Rolesville Critical Facilities/Vulnerable Populations Map)

As detailed in Appendix A Hazard Identification and Analysis, the entire area of Rolesville is exposed to general hazards such as severe storms, hurricanes, droughts and heat waves, and winter storms and freezes. Tornadoes are another common threat but the exact location of a future tornado event can not be predicted. Only flood hazards have a known hazard location – the floodplains along major streams and creeks.

Vulnerable Populations (Map B-2)

Vulnerable populations within the Town of Rolesville are identified as special needs populations (child day care center and senior citizen living centers) and mobile home parks. There is one special needs population (day care center) and one mobile home park located within the study area as shown on Map B-2. There are no senior citizen living centers within the area.

Hazardous Area Intersections with Community Features

There are no known community features located within known flood hazard areas.

Flood Hazard Areas (Map B-2)

There are minimal flood hazard areas within the current planning jurisdiction as shown on Map B-2. There is a small area of flood hazard at the far eastern boundary of the ETJ along Cedar Fork and an even smaller flood hazard area along a tributary to Sanford Creek at the far western boundary of the ETJ. No structures exist within these areas.

National Flood Insurance Program

Rolesville is an active participant in the National Flood Insurance Program (NFIP). Although the position of the Federal government is to discourage development within flood hazard areas, the NFIP was created to ensure that owners of flood susceptible properties could purchase flood insurance coverage. According to NFIP statistics there have been no flood insurance policies issued to property owners within the Town of Rolesville.

Repetitive Loss Claims

One of the main objectives of the hazard mitigation planning process is to determine how best to reduce repetitive loss claims. Through FEMA, the Federal government annually makes available grants to local governments for the purchase and/or elevation of repetitive loss flood prone properties in order to reduce the re-occurrence of flood damages. NFIP statistics indicate there are no repetitive flood loss claims within the Town of Rolesville.

High Wind Hazard Vulnerability

Predicting where damage from high winds and tornadoes will occur is impossible. Mobile/manufactured homes, however, are more vulnerable to the damaging effects of high winds than are site-built structures. Mobile/manufactured homes built prior to 1993 when more rigorous Department of Housing and Urban Development (HUD) wind resistance standards became effective are especially susceptible to wind damage (Table B-6). County tax and building permit records do not specify the age of individual mobile/manufactured home units, nonetheless, in the 2000 Census, 64 (16.7%) of all residential units within the Town of Rolesville were mobile/manufactured homes units. All of these units regardless of age are typically more susceptible to wind damage than are site-built dwelling units.

Table B-6: HUD Wind Resistance Standards for Mobile/Manufactured Homes

Year	Wind Resistance[1]	Weight (lbs)	Anchor Requirements[2]
Pre-1993	75 mph	16,000	5-6 anchors/side
Post 1993	100 mph	40,000	11-14 anchors/side

Source: Manufactured Housing Institute, www.mfghome.org

[1] Wind resistance standards for coastal placement are more rigorous.

[2] An anchor is a weighted disc buried in the ground and attached to the manufactured unit with a steel cable.

E. Future Hazard Vulnerability

Future vulnerability can be defined as the extent to which people are expected to experience harm and the likelihood of property damage by a hazardous event if projected development were to occur. If development is allowed to occur within identified floodplains, then vulnerability will increase accordingly.

The population of Rolesville has increased significantly in recent years (Table B-7). Growth is projected to accelerate to 15-20% annual growth through 2010. In the last few years the town has approved the subdivision of 870 new residential lots. Assuming that these new lots will all be built and occupied by 2010, the population will increase to 3,220 (1,253 housing units X 2.57 persons/household) by 2010. A more modulated growth rate of 250% from 2010 to 2020 will yield a population of approximately 11,330 (3,220 persons + 250%). (Note: These growth rates are less than actual growth rates of towns within Wake County that found themselves in similar expansion situations within the last twenty years.)

Table B-7: Projected Population - Wake County and Town of Rolesville

Year	Wake County		Town of Rolesville	
	Population Estimate	Ten-Year Growth Rate	Population Estimate	Ten-Year Growth Rate
1990	426,311	41.4%	577	50.1%
2000	627,846	48.3%	915	58.6%
2010	873,725	39.2%	3,220[1]	330%
2020	1,120,309	28.2%	11,270[2]	250%

Source: Office of State Planning, Wake County Planning Department

[1] 2010 population estimated by adding new units (870) to existing units (383) multiplied times average household size of 2.57.

[2] 2020 population projection based on continued growth at 251.9% over ten years.

This future growth and development must be encouraged in areas of low vulnerability. Strict enforcement of mitigation measures, such as hurricane building codes and flood damage prevention ordinances, will decrease the Town's vulnerability to hazards as future development occurs.

Redevelopment

Planning for redevelopment in the wake of a natural disaster also serves to reduce future vulnerability. Redevelopment should be encouraged in a manner which will result in lower vulnerability by restricting rebuilding within high-risk areas and requiring where building does occur, the use of mitigation measures such as higher finished floor elevations and flood proofing.

Urbanization

Development is not expected to contribute appreciatively to a rise in the height of general flooding in the Town in the near future; however, intense urbanization in upstream areas may contribute to higher levels of flooding in the future. Flash flood levels within small drainage basins might be expected to increase long term if mitigation measures such as on-site storm water retentions are not required for sites with high impervious surface coverage. Another long term problem may be a reduction in the amount of time between a rainfall event and actual flooding. Without mitigation, urbanization increases the likelihood of flash floods, increases the land susceptible to flooding, and reduces warning time for evacuation of susceptible populations.

F. Summary Conclusions

Current Vulnerability

The Town of Rolesville, as determined in Appendix A, is most vulnerable to droughts and heat waves; hurricanes and coastal storms; winter storms and freezes; floods; severe storms and tornadoes; and wildfires. Since droughts and heat waves have minimal impact on urbanized areas such as the Town of Rolesville, this hazard is not included in vulnerability assessment tables at the end of this section. (The Town of Rolesville water system was merged with the City of Raleigh which has an established water conservation plan for drought situations.)

Based on hazard event history, it is estimated that the Town of Rolesville has a maximum 100% exposure to hurricanes/coastal storms and winter storms/freezes. A 100% exposure means that all structures both public and private within the Town could possibly be impacted by these types of hazard events. Floods only impact flood hazard areas thus exposure is limited to development within these identified and mapped areas of Town. For severe storms/tornadoes and wildfires, it is estimated that the Town of Rolesville has a maximum 10% exposure, i.e., 10% or less of all structures within the Town could be impacted by these types of hazard events.

Table B-8: Potential Hazard Exposure

Hazard	Hazard Ranking	Estimated Level of Exposure
Droughts and Heat Waves	Moderate	Minimal
Hurricanes and Coastal Storms	Moderate	100% Exposure
Winter Storms and Freezes	High	100% Exposure
Floods	Moderate	Limited to Flood Hazard Areas
Severe Storms and Tornadoes	Moderate	10% Exposure
Wildfires	Moderate	10% Exposure

Source: Appendix A Table A-24.

Methodology for Calculating Current Hazard Exposure

Current (Year 2000) hazard exposure was estimated using the 2000 Census housing and population count and Year 2000 property tax values. The left side of Tables B-9 and B-10 summarize the vulnerability of persons and property values in the Year 2000. This information is presented in two categories - Private Development and Public Critical Facilities. (Note: Due to the limited amount of data that was available on specific monetary damages from past hazard events; it is difficult to predict exactly what monetary level of

damages can be expected with future hazard events. With better data available at the first Plan update, a more detailed analysis will be possible.)

Current Vulnerability to Hurricanes/Coastal Storms and Winter Storms/Freezes
Based on hazard event history, it is estimated that the Town of Rolesville has a maximum 100% exposure to hurricanes/coastal storms and winter storms/freezes. A 100% exposure means that all existing development - both public and private - within the Town could possibly be impacted by this type of hazard event. A dollar estimate of current exposure to these hazards is detailed on the left side of Table B-9 Current Conditions (Year 2000).

Current Vulnerability to Flooding
The Town of Rolesville currently has very limited exposure to flood hazards. There are no existing structures within flood hazard areas. At this time, the Town also does not own any public infrastructure, e.g., stormwater culverts, that are exposed to flood hazards. (Note: Major roads, highways, and bridges within the Rolesville area are owned and operated by the State of North Carolina and the Federal Highway System. Since the Town is not responsible for the operation and maintenance of these facilities, they are not included in vulnerability calculations. See Section C. Critical Facilities Tables B-4 and B-5.)

Current Vulnerability to Severe Storms/Tornadoes and Wildfires
For severe storms and tornadoes and for wildfires, it is estimated that the Town of Rolesville has a maximum 10% exposure, i.e., 10% or less of all structures within the Town could be impacted by these types of hazard events. A dollar estimate of current exposure to these hazards is detailed on the left side of Table B-10 Current Conditions (Year 2000).

Methodology for Calculating Potential Future Vulnerability (Map B-3)
The Town of Rolesville expects to grow substantially in the next two decades. Using population growth figures (Table B-7) the Town estimates that total population will increase from 915 in 2000 to over 11,200 by 2020. Using constant 2000 dollars, the property tax base is expected during the same period to increase from $68.8 million to over $843 million (Table B-9).

To estimate the number of housing units that will be required in 2020 (right side of Table B-9), 2020 population estimates were divided by the 2000 Census average household size. The number of commercial/industrial and other structures were then estimated to increase a comparable amount. Year 2020 values were predicted using the average per property values from Year 2000 multiplied by the number of projected units (constant Year 2000 dollars were assumed – no factor was used for inflation). Potential Future Conditions (Year 2020) are shown on the right side of Tables B-11 and B-12.

The Town has already instituted development standards that help reduce flood hazard exposure. The Town is also considering a number of additional measures (see Section II. Mitigation Action Plan) that will further limit development in sensitive environmental areas as well as reduce stormwater runoff through more restrictive development standards.

Future Vulnerability to Hurricanes/Coastal Storms and Winter Storms/Freezes
Future exposure to hurricanes/coastal storms and winter storms/freezes (right side of Table B-9 – Potential Future Conditions (Year 2020)) was estimated using the

methodology described above. A 100% exposure of all development - both public and private - was assumed for these two types of hazards.

Future Vulnerability to Flooding

Future flooding vulnerability of private property should not increase over time as the Town has in place regulations that limit construction in flood hazard areas. The Town will continue to enforce and enhance land use regulations that limit construction in flood hazard areas (see Section II. Mitigation Action Plan). The Town will also be considering strengthening these regulations under the 5-year Mitigation Action Plan.

Future Vulnerability to Severe Storms/Tornadoes and Wildfires

Future exposure to severe storms/tornadoes and wildfires (right side of Table B-10 – Potential Future Conditions (Year 2020)) was estimated using the methodology described above. A 10% exposure of all development – both public and private – was assumed for these two hazards.

Table B-9: Town of Rolesville Vulnerability Assessment for Hurricanes/Coastal Storms and Winter Storms/Freezes – 100%

Private Development						
Current Conditions (Year 2000)				Potential Future Conditions (Year 2020)[1]		
Type of Development	Number of Existing Private Buildings	Current Value (in 000s) (Year 2000 $)	Current Number of People	Projected Number of Private Buildings	Projected Value (in 000s) (Year 2000 $)	Projected Number of People
Single-Family Residential	294	$35,500	703	3,375	$407,500	8,700
Multi-Family Residential	25	$2,600	59	915	$95,200	105
Mobile Homes	64	$1,900	153	100	$3,000	270
Subtotal Residential	**383**	**$40,000**	**915**	**4,390**	**$505,700**	**11,270**
Commercial/Industrial	30	$10,800	0	450	$162,000	0
Other	28	$500	0	420	$7,500	0
Subtotal Non-Residential	**58**	**$11,300**	**0**	**870**	**$169,500**	**0**
Subtotal Private	**441**	**$51,300**	**915**	**5,260**	**$675,200**	**11,270**

Public Buildings and Infrastructure						
Current Conditions (Year 2000)				Potential Future Conditions (Year 2020)[1]		
Type of Development	Number of Existing Buildings and Critical Facilities	Current Replacement Value (in 000s) (Year 2000 $)	Current Number of People	Projected Number of Public Buildings and Critical Facilities	Projected Replacement Value (in 000s) (Year 2000 $)	Projected Number of People
Fire Station	1	$70	0	12	$840	0
Emergency Medical Station	1	$90	0	12	$1,080	0
Police Station	1	$40	0	12	$480	0
Public Infrastructure	2	$175	0	23	$2,013	0
Subtotal Public	**3**	**$375**	**0**	**59**	**$4,413**	**0**
Community Total	**444**	**$51,675**	**915**	**5,319**	**$679,613**	**11,2670**

[1] *2000 Data based on 2000 Census data for housing units, estimate of commercial/industrial and other properties, and tax revenue data (Wake County Revenue Department) for structures for Year 2000-2001. Number of persons in non-residential buildings assumed to be zero to avoid double counting the population.*

[2] *2020 Projections based on Town of Rolesville population projections (Table B-7) and estimated number of new dwelling units to accommodate population growth (Note: Due to fast urbanization and relatively high land prices, only a small increase in the number of mobile/manufactured homes was assumed with the number of multi-family units increased to accommodate the projected slowdown in increase of mobile/manufactured units.) Comparable percentage increase used to forecast 2020 commercial/industrial properties and municipal facilities. Number of persons in non-residential buildings assumed to be zero to avoid double counting the population.*

Table B-10: Town of Rolesville Vulnerability Assessment for Severe Storms/Tornadoes and Wildfires – 10%

Private Development						
Current Conditions (Year 2000)				Potential Future Conditions (Year 2020)[1]		
Type of Development	**Number of Existing Private Buildings**	**Current Value (in 000s) (Year 2000 $)**	**Current Number of People**	**Projected Number of Private Buildings**	**Projected Value (in 000s) (Year 2000 $)**	**Projected Number of People**
Single-Family Residential	29.4	3,550	70	337.5	40,750	870
Multi-Family Residential	2.5	260	6	91.5	9,520	10.5
Mobile Homes	6.4	190	15	10	300	27
Subtotal Residential	**38.3**	**4,000**	**92**	**439**	**50,570**	**1,127**
Commercial/Industrial	3	1,080	0	45	16,200	0
Other	2.8	50	0	42	750	0
Subtotal Non-Residential	**5.8**	**1,130**	**0**	**87**	**16,950**	**0**
Subtotal Private	**44**	**$5,130**	**92**	**526**	**67,520**	**1,127**

Public Facilities and Infrastructure						
Current Conditions (Year 2000)				Potential Future Conditions (Year 2020) [1]		
Type of Development	**Number of Existing Buildings and Critical Facilities**	**Current Replacement Value (in 000s) (Year 2000 $)**	**Current Number of People**	**Projected Number of Public Buildings and Critical Facilities**	**Projected Replacement Value (in 000s) (Year 2000 $)**	**Projected Number of People**
Fire Station	0.1	7	0	1.2	84	0
Emergency Medical Station	0.1	9	0	1.2	108	0
Police Station	0.1	4	0	1.2	48	0
Public Infrastructure	0.2	$18	0	2.3	$201	0
Subtotal Public	**1**	**$38**	**0**	**6**	**$441**	**0**
Community Total	**45**	**$5,168**	**92**	**532**	**$67,961**	**1,127**

[1] *2000 Data based on 2000 Census data for housing units, estimate of commercial/industrial and other properties, and tax revenue data (Wake County Revenue Department) for structures for Year 2000-2001. Number of persons in non-residential buildings assumed to be zero to avoid double counting the population.*

[2] 2020 Projections based on Town of Rolesville population projections (Table B-7) and estimated number of new dwelling units to accommodate population growth (Note: Due to fast urbanization and relatively high land prices, only a small increase in the number of mobile/manufactured homes was assumed with the number of multi-family units increased to accommodate the projected slowdown in increase of mobile/manufactured units.) Comparable percentage increase used to forecast 2020 commercial/industrial properties and municipal facilities. Number of persons in non-residential buildings assumed to be zero to avoid double counting the population.

Appendix C: Capability Assessment

A. Introduction

The ability of a community to develop an effective hazard mitigation plan depends upon six implementation factors specific to that unit of government:

1. Departments and Agencies
   a. Local government departments or agencies that have direct responsibility for hazard mitigation activities, (e.g., public works department responsibility for storm water system maintenance);
   b. Other local departments or agencies that may, by virtue of their work, either increase or decrease local vulnerability, (e.g., school system selection of new school construction sites);
2. Existing Policies, Programs and Ordinances;
   a. Local policies, programs and ordinances that affect hazard mitigation;
   b. State programs, (e.g., NCDOT maintenance of state-owned roads and highways);
3. Legal Capability (State authorization for local government programs);
4. Fiscal Capability (Operating budget, capital improvement program);
5. Technical capacities (Staff resources)
6. Political Climate (local political will for implementation of hazard mitigation activities).

B. Departments and Agencies

The Town of Rolesville is a local government body with a board-manager form of government. The elected Town Board of Commissioners is the decision making body for the Town. An appointed planning board serves as an advisory panel to the Commissioners on specific matters, including planning and land use. The Town Manager serves as the chief executive and along with other town staff carries out day-to-day administrative activities.

Departments and Agencies which Impact Hazard Mitigation

Table C-1: Town of Rolesville's Departments and Agencies Direct/Indirect Impact on Hazard Mitigation

Department/Agency	Impact	Function
Town Manager	Direct	The Town Manager, as chief executive for the town, is responsible for day-to-day management of all Town services including implementation and enforcement of the zoning ordinance, subdivision regulations, mobile home park ordinance, and the sewer use and waste management ordinances.
EMS/ Fire Department	Direct	Combined professional and volunteer fire department - protects the community during emergencies, enforces fire code ordinances, and provides education in fire safety. EMS services provide immediate medical response to emergencies.
Police	Direct	Responsible for protecting life and property through law enforcement and crime prevention.
Town Clerk	Indirect	Gives notice of Town Board meetings, prepares the agenda and records proceedings. The clerk is custodian of all permanent Town records and keeps track of appointments and terms for boards and commissions.

Department/Agency	Impact	Function
Planning	Direct	Town Planner is responsible for day-to-day and long range planning activities. Duties include enforcement of zoning, subdivision, landscape and appearance, and flood damage prevention ordinances as well as long range planning.
Planning Board	Indirect	Serves in an advisory capacity to the Town Board of Commissioners. Among its other duties, the board factors hazard mitigation strategies and goals into responsible town planning.
Parks and Recreation	Direct	Town Parks and Recreation Director is responsible for day-to-day and long range parks and recreation activities. Duties include parks planning and facility maintenance, athletic and cultural programs as well as special event coordination and planning
Parks and Recreation Board	Indirect	Serves in an advisory capacity to the Town Board of Commissioners on matters affecting recreation policies, programs, finances, and the acquisition and disposition of land and facilities. In addition, the Parks and Recreation Department advises on long-range recreation plans and programs.

Source: Town of Rolesville

Other Agencies / Departments

Wake County Public School System

The Wake County Public School System provides public educational programming and facilities. The school system is responsible for constructing and maintaining schools facilities. When selecting new school sites, the school system considers environmental factors that would impact the development potential of each site under consideration.

NC Department of Transportation

The NC Department of Transportation is responsible for construction and maintenance of state-owned roads and highways, including the construction and of storm water drainage systems. Sizing and maintenance of storm water drainage systems can have an impact on hazard mitigation. If inadequately sized structural elements (e.g., piping, channels, etc.) cannot handle storm water runoff, than upstream flooding will occur. Lack of maintenance especially due to insufficient resources (staff or equipment) can also increase the likelihood of system malfunction and storm water damage to system elements (e.g., culverts during flooding).

C. Existing Policies, Programs, and Ordinances

The Town of Rolesville has the statutory authority to plan for growth and development including the power to make studies, to determine growth objectives, to prepare and adopt plans for achieving those objectives, and to develop policies, ordinances, and the administrative means to implement plans.

North Carolina local government enabling legislation requires that zoning regulations, when adopted by a town, be made in accordance with a comprehensive land use plan. The existence of the land use plan and other long-term plans and policies help ensures that Town boards and staff are developing regulations and ordinances that are consistent with the overall goals of the community.

The Town of Rolesville has adopted a number of policies and ordinances that relate to or contain standards for land use. Although policies and ordinances may have not been created specifically for hazard mitigation purposes, they have been and can be utilized to implement hazard mitigation initiatives.

The following Town policies and ordinances have been reviewed:

- Rolesville Community Plan (1999)
- Rolesville Open Space and Greenway Plan (2002)
- Rolesville Unified Development Ordinance (2004)
- Flood Damage Prevention Ordinance
- Soil Erosion and Sedimentation Control
- Building Code Enforcement

The Town is a participating member of the Wake County Emergency Operations Plan and also participated in several countywide studies including a growth management plan, watershed management plan, and open space plan. Details on these studies and plans can be found in Appendix C of the Wake County Hazard Mitigation Plan.

Rolesville Community Plan (Map C-1: Rolesville Community Plan Map)

The Rolesville Community Plan was adopted in 1999 to provide a vision and goals for community development. The purpose of the plan is "to provide guidance for public and private decisions that affect Rolesville's physical development and the stewardship of the Town's natural, economic and cultural resources."

The Plan fulfills this purpose by:

1. Portraying a clear vision for the Town's physical development.
2. Outlining goals and objectives which, if used to guide public and private decisions that affect physical development, will help transform the Town's vision into reality.
3. Specifying actions that need to be taken in order to achieve the goals and objectives considered essential to realize the vision.

Goals and Objectives

The Rolesville Community Plan focuses on three physical elements of the town:

a. Land Use & Community Design
b. Greenspace: Parks, Greenways & Open Space
c. Transportation

"Land use" is defined in the plan as "identifying areas where different uses of land, such as homes, shops, and offices are located within the town". The second part of this element, "community design" addresses how these different uses of land are designed to fit into the community and to blend well with their surroundings.

The other two elements – greenspace and transportation – address how different networks weave through the town and serve various land uses. The greenspace network identifies places that should be set aside from development. The transportation network describes how people can travel between land uses, both within Rolesville and between Rolesville and neighboring communities.

Goals and objectives within these three physical element categories that pertain to hazard mitigation planning are outlined below. For a complete description of all three element goals and objectives, the reader is referred to the Rolesville Community Plan.

Land Use & Community Design Goals

Goal #7: Encourage good design for new development so that it is in harmony with the natural environment.

a. Wherever possible, maintain existing vegetation.
b. Develop a tree preservation ordinance.
c. Protect sensitive lands such as stream corridors, wetlands, and steep slopes.
d. Establish stream corridor protection standards.

Greenspace Goals: Parks, Greenways & Open Space

Goal #3: Preserve natural areas that can be used for school activities and public recreation.

a. Identify open space that is appropriate for designation as natural areas, and seek to preserve these areas for the Rolesville Community.

Goal #5: Safeguard the quality of land, air and water resources as development occurs so that the town's natural environment is conserved and enhanced.

a. In coordination with the North Carolina Rural Water Association, qualify Rolesville as a "Clean Water" community.
b. Maintain strict standards for the town's septic tank effluent pumping (STEP) wastewater system.
c. Require the creation of greenways along designated stream corridors as a condition of development within the town limits and extraterritorial jurisdiction (ETJ).
d. Encourage all residential and commercial development to be pedestrian-friendly.

Transportation Goals

Goal #1: Establish a safe and efficient transport system that provides for vehicular, pedestrian and bicycle travel.

a. Create a road network to support the land use and greenway goals.
b. Create a pedestrian-friendly environment throughout the town.

Goal # 2: Provide a transportation network that provides easy access to all parts of Rolesville and the surrounding area.

a. Ensure that a network of interconnected streets is established as development occurs.
b. Minimize road crossings of proposed greenways.

Community Plan Map & Policies

The Community Plan Map and Policies are intended to serve as a guide that illustrates the goals and objectives of the plan. These guides are to become design and development standards, fiscal tools and infrastructure decisions that will implement the Community Plan.

The Rolesville Community Plan is based on eight different types of land uses and two networks:

a. A network of greenspace that weaves through the community; and

b. A network of roads that connects the community.

Land Use & Community Design

The Community Plan Map (see map insert) illustrates the three main principles for the future of Rolesville:

a. Rolesville will focus much of its commercial development inward and along major arteries to create a vibrant center of activity.
b. The vast majority of land in Rolesville's Urban Service Area (USA) will retain an agricultural and low density residential pattern.
c. Some new types of land uses will be encouraged in Rolesville, so that as the community grows, it can meet the changing needs of its citizens and create a more balanced tax base.

Types and Locations of Development

The eight different types of land uses include:

a. Agricultural/Residential
b. Mixed Use Village (with a new town center)
c. Multifamily Residential
d. Office/Institutional
e. Retail Commercial
f. Historic Enhancement Area
g. School
h. Commercial/Light Industrial

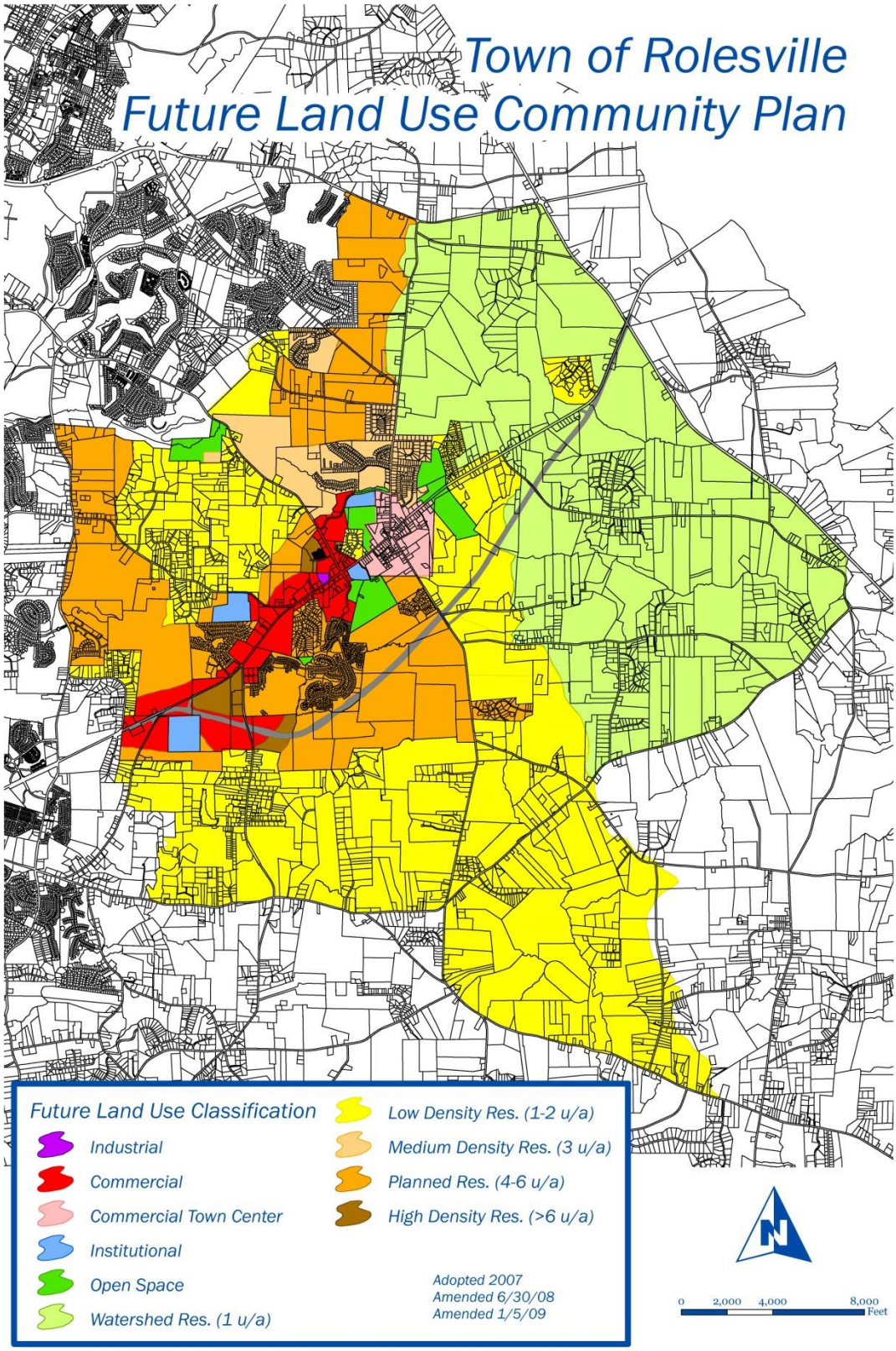
Greenspace: Parks, Greenways & Open Space

The Rolesville Community Plan focuses greenspace efforts along three creek systems that are tributaries of the Neuse River:

a. Harris Creek
b. Sanford Creek
c. Toms Creek

Each of these creek systems is designated as part of the greenway network and all seven of the designated new park areas are located along these creeks and their tributaries. In all, about 22 miles of greenways are proposed. The plan notes that an important step would be to develop a parks and recreation master plan that outlines standards for greenway protection, identifies where public trails should be located and specifies how parks, recreation facilities and greenway trails will be funded, developed and managed. In the Community Plan, the town also indicated a need to coordinate the town greenway system with the City of Raleigh and Town of Wake Forest greenway systems in order to have the town system linked to the park and greenway system along the Neuse River. (See Open Space and Greenway Plan adopted in 2002.)

Insert Map C-1: Town of Rolesville Community Plan Map



Rolesville Open Space and Greenway Plan

The Town of Rolesville developed and adopted the Open Space and Greenway Plan in order to protect the natural and cultural resources that community residents value most. The plan has three principle goals:

1. Identify parcels and corridors of land that are in need of protection and conservation measures;
2. Establish a comprehensive approach that will link greenspace lands and corridors to residential, commercial, institutional and central business areas of the community; and
3. To define a concise set of strategies for protecting and conserving these corridors and at the same time developing public use facilities that would provide residents with access to these lands and corridors.

By working towards these goals, greenways and open space are intended to protect stream corridors and their floodplains from degradation due to land use development and poor land management practices. The Plan also advocates for the protection and conservation of the primary streams of Rolesville (Harris Creek, Sanford Creek, Tom's Creek, Buffalo Creek, Perry Creek, and Cedar Fork Creek).

The Plan proposes a phased implementation program. Phase 1 focuses on the existing infrastructure and planned projects. One of the first steps identified is to establish stream buffer zones on the six stream corridors in order to protect water quality, provided protected wildlife corridors, and begin the establishment of greenway corridors. Phase 2 focuses on developing and enhancing main park facilities and greenway trails. Phase 3 will expand the greenway system and establish satellite park facilities.

The Town has made significant progress on Phase I goals. In 2002, the town began acquisition of greenways with the approval of the Villages of Rolesville Planned Unit Development. As a requirement of approval of this project, the developer will establish one mile of greenway along Powell Creek (part of the Harris Creek system). The Town is also in the process of acquiring greenway easements along an additional mile on Powell Creek, to the Harris Creek terminus. The Town has begun negotiations with three property owners along Harris Creek that will net an additional 1/3 mile of greenway. All of these acquisitions and easements are expected to be completed by early 2003. Additionally, the Town is coordinating with the NC Department of Transportation to assure that the greenway easement along the new Rolesville Bypass will connect the Powell and Harris Creek greenways.

The Town is within the Neuse River Basin and must adhere to riparian buffer rules that require a minimum 50' vegetated buffer on both sides of all intermittent and perennial streams, lakes and ponds in the river basin. This required 50' buffer consists of two zones: a 30' undisturbed zone adjacent to each side of the water body and a vegetated zone that extends from the outer edge of the 30' zone for a minimum distance of 20'. To be more progressive and add an extra degree of stream protection, the Plan recommended that the Town follow the lead of several other towns within Wake County and increase the minimum stream buffer width to 100' which was done.

The Town will be applying for Federal, State, and local government funding opportunities that are available for community development, land and water conservation and watershed protection – all of which are positively impacted by greenway development. The Town also will consider the creation of a Rolesville Greenway Trust Fund to advocate, promote, and

encourage greenway development, organize volunteers to assist with implementation and management, sponsor greenway events, and provide an outlet for donations intended specifically for greenway development projects.

Action Plan

The Open Space and Greenways Plan includes an implementation strategy that identifies twelve objectives and 33 actions to accomplish Plan objectives. Those strategies that have a direct bearing on hazard mitigation planning are listed below. For a full listing of plan strategies, the reader is referred to the Open Space and Greenways Plan.

Short Range Actions

Objective 1: Establish a greenway corridor and stream buffer zone for all major streams.

i. Initiate new land acquisitions for greenway preservation and trail development.
ii. Initiate new conservation easements on selected properties.
iii. Encourage protection of streamside trees and vegetation.
iv. Increase public education and technical assistance to property owners.
v. Encourage protection of streamside trees and vegetation.

Objective 5: Develop multi-purpose recreational trails.

i. Implement greenway trails along Harris Creek and Sanford Creek.
ii. Acquire property for regional trailheads and a water quality demonstration project.

Objective 6: Improve water quality.

i. Implement buffers along stream corridors.
ii. Acquire and/or protect parcels in water recharge areas, FEMA flood zones, and hydric soil areas.

Objective 7: Restore natural areas.

i. Implement restoration and demonstration projects.
ii. Protect stream banks and complete stream bank stabilization projects using environmentally friendly bioengineering techniques along creeks in areas which have the greatest erosion.

Objective 8: Reduce flood damage.

i. Remove or relocate repetitively damaged structures from the floodway.
ii. Limit construction in the floodway by increasing buffers along streams.

Long Range Actions

Objective 1: Develop a multi-purpose recreational trail.

i. Implement greenway trails along Tom's Creek, Buffalo Creek, and Cedar Fork Creek.
ii. Acquire property for regional trailheads.
iii. Encourage coordination with developers on trail improvement opportunities.
iv. Implement multiple use trailheads.

Objective 2: Establish seven satellite parks and one natural area. Projects include wetland parks and a rock natural area.

Objective 3: Improve water quality.

i. Increase water quality public education and technical assistance program.
ii. Work to minimize impervious surfaces and to improve infiltration.
iii. Acquire, restore and/or construct wetlands.
iv. Promote use of native vegetation.
v. Use wetland detention basin designs or retrofit existing basins.
vi. Enforce erosion and sediment controls.

Objective 4: Restore natural areas.

i. Actively manage riparian zones and natural areas to control non-native species.

Objective 5: Reduce flood damages.

i. Provide technical assistance to property owners to minimize impervious surfaces.
ii. Conduct annual stream maintenance to maintain stream channel conveyance.

Unified Development Ordinance

Subdivision Regulations (Chapter 91)

The purpose of the subdivision regulations is to establish procedures and standards for the development and subdivision of land within the territorial jurisdiction of the Town of Rolesville. The subdivision regulations are intended to "provide for the orderly growth and development of the Town of Rolesville, for the coordination of streets and highways within proposed subdivision with existing or planned streets and highways and with other public facilities; for the dedication or reservation of recreation areas serving residents of the immediate neighborhood within the subdivision and of rights-of-way or easements for street and utility purposes; and for the distribution of population and traffic in a manner that will avoid congestion and overcrowding and will create conditions essential to public health, safety, and the general welfare. The ordinance is designed to further facilitate adequate provision of water, sewerage, parks, schools and playgrounds, and also to facilitate the further re-subdivision of larger tracts into smaller parcels of land."

The subdivision ordinance requires that all subdivision plans include the exact location of the flood hazard, floodway and floodway fringe areas from FEMA maps. Section 402 of the ordinance specifies that "land which has been determined by the Board of Commissioners of the Town of Rolesville on the basis of engineering or other expert surveys to pose an ascertainable danger to life or property by reason of its unsuitability for the use proposed shall not be platted for that purpose, unless and until the sub-divider has taken the necessary measures to correct said conditions and to eliminate said dangers."

Drainage easements are required where a proposed subdivision is traversed by a stream or drainageway. The easement is required to conform to the lines of the drainageway and be of sufficient width to provide for stormwater drainage. In R-40 zoning districts, drainageway buffers are to be provided as required by the zoning ordinance.

Where no curb and gutter is required, the Town reviews all drainage prior to acceptance of any facility on the Town system. The storm drainage system is required to be designed to meet NC Department of Transportation standards and driveway drainage pipes are required to be constructed to meet a 10-year storm and be at least 15" in diameter are constructed of reinforced concrete.

Section 406.2 further stipulates that the sub-divider provide a surface storm water drainage system such that:

a. No surface water shall be channeled or directed into a sanitary sewer.
b. Where feasible, the sub-divider shall connect to an existing storm drainage system.
c. Where an existing storm drainage system cannot feasibly be extended to the subdivision, a surface drainage system shall be designed to protect the proposed development from water drainage.
d. Surface drainage courses shall have side slopes of at least 3' of horizontal distance for each 1' of vertical distance and the course shall be of sufficient size to accommodate the drainage area without flooding and designed to comply with standards and specifications for erosion control.
e. The minimum grade along the bottom of a surface drainage course shall be a vertical fall of at least 1' in each 200' of horizontal distance.
f. Stream banks and channels downstream from any land disturbing activity shall be protected from increased degradation by accelerated erosion caused by increased velocity of runoff from the land disturbing activity.
g. Anyone constructing a dam or impoundment within the subdivision must comply with the NC Dam Safety Law.
h. In all areas of special flood hazards, all subdivision proposals shall have adequate drainage provided to reduce exposure to flood damage.

Section 502 of the ordinance defines "open space" as "an area (land and/or water) generally lacking in man-made structures and reserved for enjoyment in its unaltered state." Drainageway buffers are defined as "a recorded easement or unrecorded portion of land that shall remain undisturbed except as may be necessary to accommodate:

a. Roads, provided they cross at a horizontal angle of at least sixty (60) degrees.
b. Utilities and their easements.
c. Greenways, pedestrian paths, and their easements as part of a group housing project, mobile home park, or subdivision if permitted by the Town Board of Commissioners upon finding that the buffer is the most appropriate location for the greenway or pedestrian path."

Zoning Ordinance (Chapter 92) (see Map B-1, Appendix B)
Section 103 of the ordinance states that in order to promote the health, safety, morals, and general welfare, the "ordinance is adopted by the governing body to regulate and restrict the height, number of stories, and size of buildings and other structures, the percentage of lots that may be occupied, the size of yards, courts, and other open spaces, the density of population, and the location and the use of buildings, structures, and land for trade, industry, residence, or other purposes."

Section 103 further states "the zoning regulations are in accordance with a comprehensive plan and are designed to lessen congestion in the streets; to secure safety from fire, panic, and other dangers; to promote health and the general welfare; to provide adequate light and air; to prevent the overcrowding of land; to avoid undue concentration of population; and to facilitate the adequate provision of transportation, water, sewerage, schools, parks, and other public requirements. The regulations have been made with reasonable consideration, among other things, as to the character of the jurisdiction and its areas and their peculiar suitability for particular uses, and with a view to conserving the value of buildings and encouraging the most appropriate use of land throughout the jurisdiction."

General Use Districts
Section 301 of the zoning ordinance describes the purpose of the established general use zoning districts (Table C-1). The zoning map is included in Appendix B as Map B-1 Town of Rolesville Zoning Map)

Table C-2: Town of Rolesville Zoning Districts

Zoning District	Description
R-40 W Residential Watershed District	A district whose purpose is to provide water quality protection in the drainage basin of water supply watersheds.
R-80 W Little River Watershed District	The R-80 W District is established as a district whose purpose is to provide water quality protection in the non-critical area of the drainage basin of the Little River Reservoir.
R-IS Residential I Single-Family District	A district for single-family residential development and related parks and recreation facilities only.
R-I Residential I District	A district in which the principal use of land is for single-family residential purposes. The regulations are intended to discourage any use which, because of its character, would be a nuisance to the development of residences and would be detrimental to the quiet residential natures of areas included within this district.
R-ID Residential I Duplex District	A district in which the principal use of land is for residential purposes, including two-family dwellings and group housing projects. The regulations are intended to discourage any use which, because of its character, would be a nuisance to the development of residences and would be detrimental to the quiet residential nature of the areas included within this district.
R-II Residential II District	A district in which the principal use of land is for residential purposes, excluding mobile homes. The regulations are intended to discourage any use which, because of its character, would be a nuisance to the development of residences and would be detrimental to the quiet residential nature of the areas included within this district.
R-IID Residential II Duplex District	A district in which the principal use of land is for residential purposes, including two-family dwellings and group housing projects. The regulations are intended to discourage any use which, because of its character, would be a nuisance to the development of residences and would be detrimental to the quiet residential nature of the areas included within this district.
R&PUD Residential and Planned Unit Development District	The R&PUD is established as a district in which to provide locations for development projects on land under unified control, planned as a whole, and developed in a single development operation or in a programmed series of units or stages of development, with appropriate design and site planning controls. The detailed standards for this district are provided in section 6.2.
UMH Urban Manufactured Home District	The UMH is established as a district appropriate for manufactured homes and manufactured home parks with access to public water and sewer and related parks and recreational facilities only.
ReMH Rural Manufactured Home District	The RHM District is established as a district appropriate for manufactured homes without access to public water and sewer and related parks and recreational facilities.
O&P Office and Professional	A district intended to provide an area for offices, professional activities and institutional uses and their necessary support functions, and other uses that are compatible with these uses. Conflicts with adjacent uses are to be minimized. This district may serve as a transitional district between residential and commercial uses.
C Downtown Commercial District	A district in which the principal use of land is for compact service and retail uses of the type found in the downtown area.
C-O Outlying Commercial	A district in which the principal use of land is for those service and retail trade purposes, which are properly

Zoning District	Description
District	located near residential areas and which cater to the everyday needs of residential neighborhoods.
C-W Commercial Watershed District	A district to allow for retail and service uses and at the same time provide watershed protection in the water supply watershed.
I Industrial District	A district in which the principal use of land is for industries which can be operated in a relatively clean and quiet manner and which will not be a nuisance to adjacent residential or commercial districts. The regulations are designed to prohibit the use of land for heavy industry, which should be properly segregated and to prohibit any other use which would substantially interfere with the development of industrial establishments in this district.
I-W Industrial Watershed District	A district to allow for industrial uses and at the same time provide watershed protection in the water supply watershed.

Source: Rolesville Zoning Ordinance.

Special Use Districts

The purpose of special use districts is to promote greater land use compatibility by allowing landowners to voluntarily place their property into classifications in which a special use permit is required as a prerequisite to any use or development. More specifically, the purpose of these districts is identical to that of the corresponding general use districts, except that a special use permit is required as a prerequisite to any use or development. In recognition that certain types of zoning districts would be inappropriate at particular locations in the absence of special conditions; an applicant may propose such a rezoning with special conditions. Special use districts include:

1. R-MH (SUD) Residential Mobile Home Special Use District
   This R-MH (SUD) district is designed to provide for mobile home parks. The regulations specify that "every mobile home park shall be located on ground that is above any likely flooding from any natural water source, and shall be graded so as to prevent the accumulation or ponding of water on the premises, shall have all drainage of the park confined or piped in such a way that it will not endanger any water supply." The Town also requires that the develop submit information on "the location of existing vegetation and natural areas, to include a statement as to how these areas will be protected to the greatest extent possible, with minimal clearance of existing vegetation."

2. R&PUD Residential and Planned Unit Development District
   The R&PUD district is established to provide locations for development projects on land under unified control, planned as a whole, and development in a single development operation or in a programmed series of units or stages of development, with appropriate design and site planning controls. The R&PUD District allows for the clustering of lots (with restrictions on overall density) with the stipulation that all open space resulting from clustering will be established for public use and be maintained by a Home Owners Association, or, in some cases, part or all may be dedicated to the Town and maintained by the Town. The Town requires all new residential development to set aside 5% of the land area for active recreational use.

3. NC Neighborhood Conservation Overlay District
   The NC Overlay District is established to protect the historic nature and character of the residential structures while allowing minimal intensity uses of a non-residential nature. This district encourages infill and reuse of older developed residential areas of Town thereby encouraging wise use of limited resources.

4. Watershed Districts
   Rolesville has established four zoning districts within the WS-II Balance of the Watershed Area for the Little River Water Supply Watershed:
   a. R-40W Residential Watershed District
   b. O&P-W Office and Professional Watershed District
   c. C-W Commercial Watershed District
   d. I-W Industrial Watershed District

   These districts are established in order to maintain a predominantly undeveloped land use intensity pattern. Single family residential uses are permitted at a maximum of one (1) dwelling unit per 40,000 square feet of land area.

All other residential and non-residential developed is allowed at a maximum of twelve (12) percent built upon area. Exceptions to the density and built-upon area requirements may be made for those uses permitted as a Special Intensity Allocation (SIA) as defined below:

5. Special Intensity Areas

The Rolesville ordinance allows for more intensive development within protected water supply watersheds under certain circumstances. "New and expansions of existing residential and non-residential permitted uses may occupy up to ten (10) percent of the balance of the watershed areas with a seventy (70) percent built upon area when as a special intensity allocation (SIA). Projects developed under SIA must minimize built-upon surface area, direct stormwater away from surface waters and incorporate best management practices to minimize water quality impacts."

6. Cluster Development

The clustering of development on 15,000 square foot lots rather than on 40,000 square foot lots is allowed as a special use in watershed districts under the following conditions:

a. The total number of lots shall not exceed the number of lots allowed for single family detached development. Density or built-upon area for the project shall not exceed that allowed for the critical area or balance of the watershed, whichever applies.
b. All built-upon area shall be designed and located to minimize stormwater runoff impact to the receiving waters and minimize concentrated stormwater flow.
c. The remainder of the tract shall remain in a vegetated or natural state. The title to the open space shall be conveyed to an incorporated homeowners association for management; to a local government for preservation as a park or open space; or to a conservation organization for preservation in a permanent easement.

Buffer Areas Required

A minimum one-hundred (100) feet of undisturbed vegetative buffer for development activities is required along all streams (perennial waters) indicated on the most recent versions of USGS topographic maps or as determined by local government studies. Unpaved foot and cart paths may be established within the outer 25 feet of the buffers. All buffers are measured from the top of the bank in a horizontal line, and not following the slope of the bank.

In SIAs, a minimum one-hundred (100) feet of vegetative buffer along all perennial waters as indicated above is required for all new development activities that exceed the low density option. Desirable artificial stream bank or shoreline stabilization is permitted.

No new development is allowed in the buffer except for water dependent structures, other structures such as flag poles, signs and security lights which result in only diminutive increases in impervious area and public projects such as road crossings and greenways where no practical alternative exists. These activities should minimize built-upon surface area, direct runoff away from the surface water and maximize the utilization of stormwater best management practices.

Definition of Terms:

1. Best Management Practices:
   A structural or nonstructural management based practice used singularly or in combination to reduce non-point source inputs to receiving waters in order to achieve water quality protection goals
2. Built-upon Area:
   Built-upon areas shall include that portion of a development project that is covered by impervious or partially impervious cover including buildings, pavement, gravel areas (e.g. roads, parking lots, paths), recreation facilities (e.g. tennis courts), etc. Note: Wooden slatted decks and the water area of a swimming pool are considered pervious.
3. Cluster Development:
   The grouping of buildings in order to conserve land resources and provide for innovation in the design of the project including minimizing stormwater runoff impacts. This term includes non-residential development as well as single-family residential and multi-family development. For the purpose of this ordinance, planned unit development and mixed-use developments are considered cluster development.

Landscape and Appearance Ordinance (Chapter 93)

The purpose and intent section of the ordinance states that the town "recognizes that the maintenance and enhancement of community appearance produces numerous environmental, aesthetic and economic benefits." The ordinance itself does not have any direct bearing on hazard mitigation planning other than there is a stated preference for retaining existing vegetation as a first priority over replanting.

Flood Damage Prevention (Section 31 of Chapter 92)

Section 310 of the Rolesville Zoning Ordinance establishes development standards for flood damage prevention. Specific sections of the ordinance are detailed in Table C-2. The ordinance specifies that the regulations apply to all areas of special flood hazard within the jurisdiction of the Town of Rolesville. An area of special flood hazard is defined as "the land in the floodplain within a community subject to a one percent or greater chance of being flooded in any given year."

The areas of special flood hazard are those identified by the Federal Emergency Management Agency (FEMA) in its Flood Hazard Boundary Map or Flood Insurance Study and Flood Insurance Rate Map(s) (FIRM), for the Town of Rolesville, dated March 3, 1992, which, with accompanying supporting data, and any revision thereto, including Letters of Map Amendment, or Revision, are adopted by reference and declared to be a part of this ordinance.

Table C-3: Rolesville Flood Damage Prevention Ordinance

Section	Description
Section 7.2.1.2 Findings of Fact	The flood prone areas within the jurisdiction of the Town of Rolesville are subject to periodic inundation which results in loss of life, property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures of flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety, and general welfare. These flood losses are caused by the cumulative effect of obstructions in floodplains causing increases in flood heights and velocities and by the occupancy in flood prone areas of uses vulnerable to floods or other hazards.
Section 7.2.1.3 Statement of Purpose	It is the purpose of this ordinance to promote public health, safety, and general welfare and to minimize public and private losses due to flood conditions within flood prone areas by provisions designed to: 1. restrict or prohibit uses that are dangerous to health, safety, and property due to water or erosion hazards or that result in damaging increases in erosion, flood heights or velocities; 2. require that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction; 3. control the alteration of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of floodwaters; 4. control filling, grading, dredging, and all other development that may increase erosion or flood damage; and. 5. prevent or regulate the construction of flood barriers that will unnaturally divert flood waters or which may increase flood hazards to other lands.
Section 7.2.1.4 Objectives	The objectives of this ordinance are: 1. to protect human life and health; 2. to minimize expenditure of public money for costly flood control projects; 3. to minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public; 4. to minimize prolonged business losses and interruptions; 5. to minimize damage to public facilities and utilities (i.e. water and gas mains, electric, telephone, cable and sewer lines, streets, and bridges) that are located in flood prone areas; 6. to help maintain a stable tax base by providing for the sound use and development of flood prone areas; and 7. to ensure that potential buyers are aware that property is in a Special Flood Hazard Area or Future Conditions Flood Hazard Area.

Areas of special flood hazard also include those defined through standard engineering analysis for private developments or by government agencies, but which have not yet been incorporated in the FIRM. This includes detailed flood information generated as a requirement of the ordinance. The North Carolina Floodplain Mapping Program is currently updating FIRM maps for all of Wake County using state of the art techniques. The current flood damage prevention ordinance will likely be updated to reflect new floodplain information from the FEMA flood study.

Development Permit

The Town requires that the owner/developer of property apply for a development permit. The application must include information on the nature, location, dimensions and elevations of the area in question; existing or proposed structures; and the location of fill materials, storage areas and drainage facilities.

Variance Procedures

The ordinance provides for the issuance of a variance by the Town Board of Adjustment in unusual circumstances. In passing upon a variance application, the Board of Adjustment is charged with considering all technical evaluations, all relevant factors, all standards specified in the ordinance.

Variances may not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result. The board of adjustment may attach conditions to the granting of a variance, as the board deems necessary. Conditions for variances include:

(i) Variances may not be issued when the variance will make the structure in violation of other federal, State, or local laws, regulations, or ordinances.
(ii) Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.
(iii) Variances shall only be issued upon:
    (i) a showing of good and sufficient cause;
    (ii) a determination that failure to grant the variance would result in exceptional hardship;
    (iii) a determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisance, cause fraud on or victimization of the public, or conflict with existing local laws or ordinances.
(iv) Any applicant to whom a variance is granted shall be given written notice specifying the difference between the base flood elevation and the elevation to which the structure is to be built and a written statement that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced lowest flood elevation. Such notification shall be maintained with a record of all variance actions.
(v) The local administrator shall maintain records of all appeal actions and report any variance to the Federal Emergency Management Agency upon request.

Provisions for Flood Hazard Reduction

In all areas of special flood hazard the following general standards are required:

i. All new construction and substantial improvements shall be anchored to prevent flotation, collapse or lateral movement of the structure.

ii. All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage;
iii. All new construction or substantial improvements shall be constructed by methods and practices that minimize flood damages;
iv. Electrical, heating, ventilation, plumbing, air conditioning equipment, and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding;
v. All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the systems;
vi. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters;
vii. On-site waste disposal systems shall be located and constructed to avoid impairment to them or contamination from them during flooding; and
viii. Any alteration, repair, reconstruction of improvements to a structure which is in compliance with the provisions of this ordinance, shall meet the requirements of "new construction" as contained in this ordinance.
ix. Non-Conforming Buildings or Uses. Non-conforming buildings or uses may not be enlarged, replaced, or rebuilt unless such enlargement or reconstruction is accomplished in conformance with the provisions of the ordinance. This assumes nothing in this ordinance shall prevent the repair, reconstruction, or replacement of a building or structure existing on the effective date of this ordinance and that the property is located totally or partially within the floodway or stream setback, provided that the bulk of the building or structure below base flood elevation in the floodway or stream setback is not increased and provided that such repair, reconstruction, or replacement meets all of the other requirements of this ordinance.

In all areas of special flood hazard the following specific standards are required regarding residential construction, non-residential construction, manufactured homes, recreational vehicles, elevated buildings, temporary structures, accessory structures, and floodways can be found in Section 310.5.2 of the ordinance. Standards for streams without established base flood elevations and/or floodways where no base flood data has been provided or where no floodways have been identified are established in Section 310.5.3 of the ordinance. Standards for subdivision proposals and major developments (Section 310.5.4) include:

(i) Proposals shall be consistent with the need to minimize flood damage.
(ii) Proposals shall have public utilities and facilities such as sewer, gas, electrical and water systems located/constructed to minimize flood damage.
(iii) Proposals shall have adequate drainage provided to reduce exposure to flood hazards.
(iv) Base flood elevation data shall be provided where the proposed development is greater than the lesser of fifty lots or five acres.

Mobile Home Provisions (Chapter 92 Article VI)

This section does not address flood hazard mitigation. Specific requirements for mobile (manufactured) home placement are addressed in Chapter 92 Section 31 Flood Hazard Prevention.

Soil Erosion and Sedimentation Control

The regulation of soil erosion and sedimentation control requires that land disturbing activities be monitored to control accelerated erosion and loss of sediment. Controlling erosion and sedimentation reduces the loss of valuable topsoil and reduces the likelihood of water pollution and damage to watercourses. Although its intended purpose is not targeted at hazard mitigation, it can impact mitigation initiatives.

By state law, no construction activity that would disturb greater than one acre of land can commence until an erosion and sedimentation control plan has been approved. Control measures must be designed and constructed to provide protection from peak runoff from a 10-year storm. Wake County enforces the soil erosion and sedimentation control within the planning jurisdiction of the Town of Rolesville.

Building Code Enforcement

Wake County enforces the North Carolina State Building Code within the Town of Rolesville's planning jurisdiction.

Community Capability Assessment Summary

The overall assessment of Town of Rolesville community capability to address hazard mitigation through existing policies and ordinances is summarized in Table C-4.

Incorporating Hazard Mitigation Requirements into Community Plans

No policies, programs or ordinances have been found to have the effect of hindering hazard mitigation; however, there are opportunities to make current policies more effective for mitigation. Existing policies and ordinances are regularly reviewed and considered for updates/revisions to meet changing community needs and to stay in compliance with State and Federal regulations.

The Town will create a process to incorporate requirements in the Hazard Mitigation Plan into existing community plans and ordinances. The Town Manager will be responsible for providing a copy of the Hazard Mitigation Plan to each Town department and for ensuring that the responsible department (see Table C-4) incorporates hazard mitigation goals, objectives and actions into plan updates and ordinance revisions to ensure that updates and revisions do not contribute to increased community vulnerability to natural hazards.

The specific departments, as noted in Table C-4, that are responsible for implementation, enforcement, and updates to community plans and ordinances will be charged with monitoring programs and regulations for opportunities to improve hazard mitigation actions. More specific information on recommendations for new or revised policies and programs is detailed in Section II. Mitigation Action Plan.

Table C-4: Community Capability Assessment Summary – Town of Rolesville

Title/Effective Date	Purpose/Rationale for Effectiveness	Effectiveness for Mitigation	Recommendations for Incorporating Hazard Mitigation into Existing Plans and Mechanisms	How the Mitigation Plan has been Incorporated into Other Plans
Community Plan (2004)	The Community Plan provides guidance for public and private decisions that impact the physical development of the Town and the stewardship of the Town's natural, economic and cultural resources.	Moderate	When updated, the future land use element of the Community Plan should seek to focus development away from potential hazard areas.	The Community Plan has not been updated since the adoption of the Hazard Mitigation Plan.
Open Space and Greenway Plan (2002)	The Open Space and Greenway Plan seeks to protect natural and cultural resources by identifying parcels and corridors for conservation; by establishing a comprehensive approach for a greenway corridor system; and by defining a set of strategies for protecting and conserving greenway corridors.	Moderate	This Plan identifies certain areas that are in need of protection and conservation while continually striving to maximize land use. Future iterations could discuss the benefit of open space with respect to elements of the Hazard Mitigation Plan, specifically as a highest and best use for flood prone areas.	The Open Space and Greenway Plan has not been updated since the adoption of the Hazard Mitigation Plan.
Subdivision Regulations (2001)	Subdivision regulations control the division of land for purposes of sale or building development.	Moderate	The Subdivision Regulations currently address street and lot design. The technical specifications mirror those set forth by NCDOT. Future revisions could call out specific potential hazards and how the mitigation measures will minimize detrimental impact.	The Subdivision Regulations have not been updated or revised since the adoption of the Hazard Mitigation Plan.
Zoning Ordinance (2001)	The zoning ordinance regulates the use of land for residential and non-residential development.	Moderate	Revisions to the Zoning Ordinance (text amendments) should incorporate recommendations from the Hazard Mitigation Plan when possible; specifically guiding development in a manner that supports the findings of the Plan.	The Zoning Ordinance is updated continually through the text amendment process. The Hazard Mitigation Plan serves as a baseline reference when analyzing the repercussions of any given change. No change has been made that is contrary to the information found in the Plan.

Title/Effective Date	Purpose/Rationale for Effectiveness	Effectiveness for Mitigation	Recommendations for Incorporating Hazard Mitigation into Existing Plans and Mechanisms	How the Mitigation Plan has been Incorporated into Other Plans
Flood Damage Prevention Ordinance (2001)	The flood damage prevention ordinance seeks to minimize public and private losses due to flood conditions in specific flood hazard areas.	High	This Ordinance prohibits uses of areas that are hazard prone, limits development in those areas and restricts construction to decrease community vulnerability, paralleling the recommendations of the Hazard Mitigation Plan.	Although the Flood Damage Prevention Ordinance has not been updated since the adoption of the Hazard Mitigation Plan, the two plans are not inconsistent with one another.
Landscape and Appearance Ordinance (2001)	The Landscape and Appearance Ordinance seeks to maintain and enhance community appearance through aesthetic controls.	Moderate	While this ordinance does not have any direct bearing on hazard mitigation planning, future iterations should include a preference for existing and "native" plantings which are adapted to the local climate. These plants would be more likely to withstand drought and/or heavy rain events than non-native species.	The Landscape and Appearance Ordinance has not been updated since the adoption of the Hazard Mitigation Plan.
Soil Erosion and Sedimentation Control (2009)	The Soil Erosion and Sedimentation Control ordinance regulates the disturbance of soil during construction to minimize soil erosion and sedimentation.	High	The Soil Erosion and Sedimentation Control ordinance should regulate certain land-disturbing activities to control accelerated erosion and sedimentation in order to prevent pollution of water and other damage to lakes, watercourses, and other public and privately owned property by sedimentation, in support of the Hazard Mitigation Plan.	The Town, through an agreement with Wake County, adopted a comprehensive Stormwater Management ordinance in 2009. This agreement gives Wake County permitting authority over all stormwater related issues and thereby addresses numerous concerns outlined in the Hazard Mitigation Plan.
NC State Building Code	The NC State Building Code sets minimum standards for building construction.	High	N/A. The Town does not have the authority to change the NC State Building Code. Further, the Town contracts with Wake County for building code enforcement.	The Town does not have the authority to change the NC State Building Code.

Source: Town of Rolesville.

D. Legal Capability

Local governments in North Carolina have a wide array of powers that enable counties and municipalities to adopt and implement policies and ordinances that may be used to mitigate the potential harmful effects of natural hazards. Below is a summary of the legal authority and powers that North Carolina has conferred on local governments within the state (*Local Hazard Mitigation Planning Manual*, NC Division of Emergency Management, 1998, Appendix B, pp. 61-64.) These powers fall into four broad categories: regulation, acquisition, taxation, and spending.

Regulation (General Police Power)

Local governments in North Carolina have been granted broad regulatory powers. North Carolina bestows the general police power on local governments, allowing them to enact and enforce ordinances which define, prohibit, regulate, or abate acts, omissions, or conditions detrimental to the health, safety, and welfare of the people and to define and abate nuisances (including public health nuisances). Since hazard mitigation can be included under the police power (as protection of public health, safety and welfare), towns, cities and counties may include requirements for hazard mitigation in local ordinances. Local governments may also use their ordinance-making power to abate "nuisances," which could include, by local definition, any activity or condition making people or property more vulnerable to any hazard (NCGS 160A Art. 8 (Delegation and Exercise of the General Police Power to Cities and Towns); 153A, Art. 6 (Delegation and Exercise of the General Police Power to Counties)).

Town of Rolesville

The Town of Rolesville has enacted and enforces regulatory ordinances designed to promote the public health, safety and general welfare of its citizens. These ordinances are listed and described in detail in this section.

Building Codes and Building Inspection

Many structural mitigation measures involve constructing and retrofitting homes, businesses and other structures according to standards designed to make the buildings more resilient to the impacts of natural hazards. Most of these standards are imposed through the building code.

North Carolina has a state compulsory building code, which applies throughout the state (NCGS 143-338(c)). However, municipalities and counties may adopt codes for their respective areas if approved by the state as providing "adequate minimum standards" (NCGS 143-338(e)). Local regulations cannot be less restrictive than the state code. Exempted from the state code are: public utility facilities other than buildings; liquefied petroleum gas and liquid fertilizer installations; and farm buildings outside municipal jurisdictions. No state permit may be required for structures under $20,000. (Note that exemptions apply only to state, not local, permits).

Local governments in North Carolina are also empowered to carry out building inspections. NCGS 160A, Art. 19. Part 5; and 153A Art. 18, Part 4 empower cities and counties to create an inspection department, and enumerates department duties and responsibilities, which include enforcing state and local laws relating to the construction of buildings, installation of plumbing, electrical, heating systems, etc.; building maintenance; and other matters.

Town of Rolesville

Through inter-local agreement, Wake County enforces the building code within the Town of Rolesville, which is compliant with the NC State Building Code.

Land Use

Land use regulatory powers granted by the state to local governments are the most basic manner in which a local government can control the use of land within its jurisdiction. Through various land use regulatory powers, a local government can control the amount, timing, density, quality and location of new development. All these characteristics of growth can determine the level of vulnerability of the community in the event of a natural hazard. Land use regulatory powers include the power to engage in planning, and to enact and enforce zoning ordinances, floodplain ordinances, and subdivision controls.

Each community possesses great power to prevent unsuitable development in hazard-prone areas. (NCGS 160A, Art. 8. (Delegation and Exercise of the General Police Powers to Cities and Towns); Art. 19 (Planning); Part 3 (Zoning); and 153A. Art. 6 (Delegation and Exercise of the General Police Power to Counties; Art. 18 (Planning and Regulation of Development); Part 2 (Subdivision Regulation); Part 3 (Zoning).

Planning

In order to exercise the regulatory powers conferred by the General Statutes, local governments in North Carolina are required to create or designate a planning agency (NCGS 160A-3 87). The planning agency may perform a number of duties, including: make studies of the area; determine objectives; prepare and adopt plans for achieving those objectives; develop and recommend policies, ordinances, and administrative means to implement plans; and perform other related duties (NCGS 160A-361).

The importance of the planning powers of local governments is emphasized in NCGS 160A-383, which requires that zoning regulations be made in accordance with a comprehensive plan. While the ordinance itself may provide evidence that zoning is being conducted “in accordance with a plan”, the existence of a separate planning document ensures that the government is developing regulations and ordinances that are consistent with the overall goals of the community.

Town of Rolesville

The Town has established a Planning Board to advise the Board of Commissioners on planning issues. The Town has also adopted two community wide planning documents – the Rolesville Community Plan and the Rolesville Open Space and Greenway Plan.

Zoning

Zoning is the traditional and nearly universal tool available to local governments to control the use of land. Broad enabling authority for municipalities in North Carolina to engage in zoning is granted in NCGS 160A-381; and for counties in NCGS 153A-340. (Counties may also regulate inside a municipal jurisdiction at the request of a municipality (NCGS 160A-360(d)). The statutory purpose for the grant of power is to promote health, safety, morals or the general welfare of the community. Land uses controlled by zoning include the type of use (residential, commercial, industrial) as well as minimum specifications such as lot size, building height and setbacks, density of population, etc.

Local governments are authorized to divide their territorial jurisdictions into districts, and to regulate and restrict the erection, construction, reconstruction, alteration, repair, or use of buildings, structures or land within those districts (NCGS 160A-382). Districts may include general use districts, overlay districts, and special use or conditional use districts. Zoning ordinances consist of maps and written text.

Town of Rolesville

The Town of Rolesville has a zoning ordinance that establishes zoning districts and minimum development regulations.

Subdivision Regulations

Subdivision regulations control the division of land into parcels for the purpose of building development or sale. Flood-related subdivision controls typically require that subdividers install adequate drainage facilities and design water and sewer systems to minimize flood damage and contamination. Subdivision regulations prohibit the subdivision of land subject to flooding unless flood hazards are overcome through filling or other measures. Subdivision regulations are a more limited tool than zoning and only indirectly affect the type of use made of land or the minimum specifications for structures.

Broad subdivision control enabling authority for municipalities is granted in NCGS 160-371, and in 153-330 for counties outside of municipalities and municipal extraterritorial planning jurisdictions. Subdivision is defined as all divisions of a tract or parcel of land into two or more lots and all divisions involving a new street (NCGS 160A-376). The definition of subdivision does not include the division of land into parcels greater than 10 acres where no street right-of-way dedication is involved (NCGS 160A-376(2)).

Town of Rolesville

The Town of Rolesville has adopted a Unified Development Ordinance, which was most recently amended in August 2004. The ordinance establishes minimum standards for land division for the purposes of sale and development.

Floodplain Regulation

In the summer of 2000, the North Carolina General Assembly adopted an act entitled "An Act to Prevent Inappropriate Development in the One Hundred-Year Floodplain and to Reduce Flood Hazards". By this act, the North Carolina statutes regulating development within floodways were rewritten to include floodplain regulation (NCGS 143-314.51-214.61). The purpose of the new law is to:

1. Minimize the extent of floods by preventing obstructions that inhibit water flow and increase flood height and damage.
2. Prevent and minimize loss of life, injuries, property damage and other losses in flood hazard areas.
3. Promote the public health, safety and welfare of citizens of North Carolina in flood hazard areas.

The new statute authorizes local governments to adopt a flood hazard prevention ordinance to regulate uses in flood hazard areas and to grant permits for the use of flood hazard areas that are consistent with the requirements of the statute. The statute provides for certain uses within flood hazard areas without a permit consistent with local land use ordinances (NCGS 143-315.54).

The statute establishes minimum standards for local ordinances and provides for variances for prohibited uses as follows:

(a) A flood hazard prevention ordinance adopted by a county or city pursuant to this Part shall, at a minimum:
    (1) Meet the requirements for participation in the National Flood Insurance Program and of this section.
    (2) Prohibit new solid waste disposal facilities, hazardous waste management facilities, salvage yards, and chemical storage facilities in the 100-year floodplain except as noted in section (b) below.
    (3) Provide that a structure or tank for chemical or fuel storage incidental to a use that is allowed under this section or to the operation of a water treatment plant or wastewater treatment facility may be located in a 100-year floodplain only if the structure or tank is either elevated above base flood elevation or designed to be watertight with walls substantially impermeable to the passage of water and with structural components capable of resisting hydrostatic and hydrodynamic loads and the effects of buoyancy.

(b) A flood hazard prevention ordinance may include a procedure for granting variances for uses prohibited under G.S. 143-315.54(c). A county or city shall notify the Secretary (of Crime Control and Public Safety) of its intention to grant a variance at least 30 days prior to granting the variance. A county or city may grant a variance upon finding that all of the following apply:
    (1) The use serves a critical need in the community.
    (2) No feasible location exists for the location of the use outside the 100-year floodplain.
    (3) The lowest floor of any structure is elevated above the base flood elevation or is designed to be watertight with walls substantially impermeable to the passage of water and with structural components capable of resisting hydrostatic and hydrodynamic loads and the effects of buoyancy.
    (4) The use complies with all other applicable laws and regulations.

The statute authorizes priority ratings for local government applications for revolving loans or grants based on adoption of a local comprehensive land use plan, a zoning ordinance, or other measures that significantly contribute to the implementation of the comprehensive land use plan and the flood hazard prevention ordinance.

The Floodplain Act also instructed the Environmental Review Commission to study and report its findings to the 2001 General Assembly on the need to:

(1) Increase the minimum elevation requirement.
(2) Increase the authority of the Secretary of Crime Control and Public Safety to enforce the new statute.

(3) Increase protection against the potential recurrence of damage to public and private property that resulted from the hurricanes of 1999, and other measures to reduce the likelihood that public assistance will be needed in response to future hurricanes and other storm events.

Town of Rolesville

The Town of Rolesville has adopted a Flood Damage Prevention Ordinance as a part of the town zoning ordinance.

Acquisition

The power of acquisition can be a useful tool for pursuing mitigation goals. Local governments may find the most effective method for completely "hazard-proofing" a particular piece of property is to acquire the property (either in fee simple or a lesser interest, such as an easement). Public acquisition removes the property from the private market and eliminates or reduces the possibility of inappropriate development. North Carolina legislation empowers cities and counties to acquire property for public purpose by gift, grant, devise, bequest, exchange, purchase, lease or eminent domain (NCGS 153A. Art. 8; 160A. Art. 11).

Taxation

The power to levy taxes and special assessments is an important tool delegated to local governments by North Carolina law. The power of taxation extends beyond merely the collection of revenue and can have a profound impact on the pattern of development in a community. Communities can set preferential tax rates for areas, which are unsuitable for development (e.g., agricultural land, wetlands, and floodplains) to discourage development in hazardous areas.

Because the usual methods of apportionment seem mechanical and arbitrary, and because the tax burden on a particular piece of property is often quite large, the major constraint in using special assessments is political. Special assessments seem to offer little in terms of control over land use in developing areas. Assessments can, however, be used to finance the provision of necessary services within city or county boundaries. In addition, they are useful in distributing to new property owners the costs of the infrastructure required by new development.

Town of Rolesville

The Town levies property taxes but does not use preferential tax districts or special assessments for purposes of guiding growth and development.

Spending

The fourth major power that has been delegated by the North Carolina General Assembly to local governments is the power to make expenditures in the public interest. Hazard mitigation principles should be made a routine part of all spending decisions made by a local government, including adoption of annual budgets and a capital improvement plan (CIP).

A CIP is a schedule for the provision of city or county services over a specified period of time. Capital programming, by itself, can be used as a growth management technique, with a view to hazard mitigation. By tentatively committing itself to a timetable for the provision of capital to extend services, a community can control growth to some extent especially in areas where the provision of on-site sewage disposal and water supply are unusually expensive.

In addition to formulating a timetable for the provision of services, a local community can regulate the extension of and access to services. A CIP that is coordinated with extension and access policies can provide a significant degree of control over the location and timing of growth. These tools can also influence the cost of growth. If the CIP is effective in directing growth away from environmentally sensitive or high hazard areas, for example, it can reduce public costs associated with degradation of the environment and damages to properties caused by natural hazards.

E. Fiscal Capability

Beyond legal authority and political willpower, fiscal capability is a key component to effectively developing and implementing a hazard mitigation plan. In addition to local tax funds, non-profits and other non-governmental organizations are often interested in helping to implement hazard mitigation projects. Local governments can also apply for State and Federal funds to implement hazard mitigation initiatives. In determining fiscal capabilities, the NC Emergency Management (NCEM) website has more information including a listing of over 300 funding sources available to communities. The NCEM website address is: http://www.ncem.org/Mitigation/additional_funding.htm.

Local Funds

In North Carolina, property taxes provide the primary source of revenue for local governments. These taxes are typically used primarily to finance services that must be available and delivered on a daily basis by counties and towns. Fortunately, State and Federal funds are available to local governments for the development and implementation of hazard mitigation programs.

State and Federal Funds

There are a variety of Federal and State funding sources available to local governments for the purpose of implementing hazard mitigation plans. These programs include Hazard Mitigation Grants, Flood Mitigation Assistance Programs, and Community Development Block Grants. A more exhaustive list and explanation of Federal and State funding sources can be found in Appendix D.

Non-Governmental Funds

Another potential source of revenue for local mitigation efforts, are the contributions of non-governmental organizations, such as churches, charities, community relief funds, the Red Cross, hospitals, for-profit businesses, and nonprofit organizations. A variety of these local organizations can be tapped to help carry out local hazard mitigation initiatives.

Ability to Pay

In recognition of the disparate economic prosperity of the State's one hundred counties, the NC Department of Commerce ranks counties in an economic tier system. The impetus for this system was the William S. Lee Quality Jobs and Business Expansion Act of 1996 (Lee Act) which provides for a sliding scale of state tax credits for economic investment. The Lee Act has become the State's main development tool in an effort to help smaller rural counties be more economically competitive. The tier ranking is also used by the State as a measure of an individual county's ability to pay when applying for state and federal grants.

The most economically distressed counties are ranked in Tier 1 and the most economically prosperous in Tier 5. The rankings are evaluated annually using three factors – population growth, unemployment rate, and per capita income. The 2003 NC Department of Commerce placed Wake County in Tier 5.

F. Technical Capability – Staff Resources

Effective hazard mitigation initiatives depend largely on a community's technical capability. The Town of Rolesville has a wide variety of technical capabilities available to aid in hazard mitigation efforts. The Town's most valuable technological resource is the wealth of knowledge accumulated by its personnel through their years of experience. Many local governments in North Carolina have only limited technical capabilities due to size and budget restrictions. Although, together with aid from Wake County, these technical capabilities can help build a more resilient community by implementing better planning before the occurrence of a natural hazard, as well as better response during the event and recovery period.

Administration

This department is responsible for the day-to-day activities of the Town. This department consists of the Town manager who also serves as the chief executive for the Town and manages all the services of the Town including implementation and enforcement of zoning ordinance, subdivision regulations, mobile home park ordinance, and the sewer use and waste management ordinance.

Emergency Management Services and Fire Department

This department is responsible for protecting the community during emergencies while enforcing the fire code ordinances, and provides education in fire safety. The EMS service provides immediate medical response to emergencies.

Police Department

This department is responsible for protecting life and property through law enforcement and crime prevention.

Town Clerk

This department serves the Town Board during meetings, prepares agenda and records proceedings. The Town clerk also is the custodian of all permanent and termed boards and commissions.

Planning Board

This board serves as an advisory body to the Town Board of Commissioners, and also factors mitigation actions into responsible town planning.

Parks and Recreation Advisory Board

This advisory board provides advice to the Town on matters affecting recreation policy programs, finances, and the acquisition and disposition of land and facilities.

G. Political Climate

The elected officials of the Town of Rolesville are in agreement that implementation of the Hazard Mitigation Plan is a necessary step to minimize damages from natural hazards. The Board of Commissioners supports the need for hazard mitigation to reduce future loss of life and property and will vigorously support hazard mitigation efforts.

The Town of Rolesville has experienced the devastating effects of natural hazards (Hurricane Fran and other general flooding events as well as recent ice storms). The citizens, property owners, business owners, as well as elected officials are confident in the need for a Hazard Mitigation Plan. The Mayor of Rolesville along with the elected board members continually strive to make the Town of Rolesville a safer community and see the Hazard Mitigation Plan as a means to help achieve that goal.

Appendix D: State and Federal Resources

ORGANIZATIONS

North Carolina Division of Emergency Management
Web: http://www.ncem.org/mitigations/index.htm
1830-B Tillery Place
Raleigh, NC 27604
Telephone: 919-715-8000

North Carolina Center for Geographic Information and Analysis (CGIA)
Web: http://www.cgia.state.nc.us
301 N. Wilmington Street, Suite 700
Raleigh, NC 27601-2825
Telephone: 919-733-2090

UNC-CH Department of City and Regional Planning
Web: http://www.unc.edu.depts/dcrpweb/
New East, Campus Box 3140
The University of North Carolina-Chapel Hill
Chapel Hill, NC *27599-3140*
Telephone: 919-962-4775

North Carolina Division of Coastal Management (DCM)
Web: http://dcm2.enr.state.nc.us/
P0 Box 27687
Raleigh, NC 27611-7687
Telephone: 919-733-2293

DCM Field Offices

Elizabeth City	252-264-3901
Morehead City	252-808-2808
Washington	252-946-6481
Wilmington	910-395-3900

North Carolina Division of Community Assistance (DCA)
Web: http://www.dca.commerce.state.nc.us/
1307 Glenwood Avenue, Suite 250
Raleigh, NC 27605
Telephone: 919-733-2850

North Carolina League of Municipalities
Web: http://www.nclm.org
P0 Box 3069/2 15 N. Dawson Street
Raleigh, NC 27602
Telephone: 919-715-4000

North Carolina State Data Center
Web: http://sdc.state.nc.us
116 West Jones Street
Raleigh, NC 27603-8003
Telephone: 919-733-4131

Federal Emergency Management Agency (FEMA)
Web: http://www.fema.gov/about/regoff.htm
500 C Street SW
Washington, DC20472
Telephone: 202 646-3923

FEMA Regional Office
3003 Chamblee-Tucker Road
Atlanta, GA 30341
Telephone: 770-220-5200

FEMA National Emergency Training Center
Web: http://www.usfa.fema.gov/nfa/tr_eenet.htm
16825 South Seton Avenue
Emmitsburg, MD 21727
Telephone: 301-447-1000

Office of Management and Budget (OMB)
Web: http://www.whitehouse.gov/omb/
New Executive Office Building
725 17th Street, NW, Room 8002
Washington, DC 20503
Telephone: 202-395-3080

Small Business Administration (SBA)
Web: http://www.sbaonline.sba.gov/DISASTER
Disaster Assistance Division
Office of Disaster Assistance
409 Third Street SW
Washington, DC 20416
Telephone: 202-205-6734

U.S. Army Corps of Engineers (USACE)
Web: http://www.usace.army.mil
Floodplain Management Services and Coastal Resources Branch
20 Massachusetts Avenue NW
Washington, DC 20314
Telephone: 202-272-0169

U.S. Geological Survey (USGS)
Web: http://www.usgs.gov
807 National Center
12201 Sunrise Valley Drive
Reston, VA 20192
Telephone: 703-648-4000

U.S. Department of Housing and Urban Development (HUD)
Web: http://www.hud.gov
Community Planning and Development
Office of Block Grant Assistance
451 7th Street SW -
Washington, DC 20410-7000
Telephone: 202-708-1871

PUBLICATIONS AND DATA

North Carolina Division of Emergency Management
Risk Management Branch (919-715-8000)

- *Tools and Techniques for Mitigating the Effects of Natural Hazards*, 1998
- *Best Mitigation Practices for Local Governments*, 2001
- *Disaster Recovery Manual*
- *Hazard Data Diskettes (County level)*
- *Flood Insurance Rate Maps (FIRMs* also available from the NFIP Map Service Center at 1-80-358-9616)

Federal Emergency Management Agency (FEMA)
Available from the FEMA Distribution Facility (1-800-480-2520)

- *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA publication #386-2, 2001)
- *Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments* (FEMA publication #131, 1990)
- *Guide for the Review Of State and Local Emergency Operation Plans*
- *Disaster Assistance: A Guide to Recovery Programs* (FEMA publication #229(4))
- *Mitigation: Cornerstone for Building Safer Communities*, 1995

Center for Urban and Regional Studies (CURS)

- *Making Mitigation Work: Recasting Natural Hazards Planning and Implementation,* February 1997

National League of Municipalities (NLM)

- *Emergency Management Mini-Guide*, 1992

Office of Management and Budget (OBM)

Federal Programs Offering Non-Structural Flood Recovery and Floodplain Management Alternatives – available by fax (202-395-4817) or from FEMA library website – http://www.fema.gov/library/ombflood/pdf

Appendix E: Glossary

Best Management Practices (BMPs)
A structural or nonstructural management based practice used singularly or in combination to reduce non-point source inputs to receiving waters in order to achieve water quality protection goals.

BFE - Base Food Elevation

Built-Upon Area
Built-upon areas shall include that portion of a development project that is covered by impervious or partially impervious cover including buildings, pavement, gravel areas, recreation facilities, etc. Wooden slatted decks and the water area of a swimming pool are considered pervious.

Cluster Development:
The grouping of buildings in order to conserve land resources and provide for innovation in the design of the project including minimizing stormwater runoff impacts. This term includes non-residential development as well as single-family residential and multi-family development.

Critical Area
The land in a water supply watershed which is adjacent and draining to the water source, where it is most important to filter out potential pollutants.

Dam Types - NC Department of Environment and Natural Resources

- RE – Rolled Earth
- ER – Rockfill
- CNCB – Concrete Buttress
- CNMVCB – Concrete Multiple Arch with Buttresses
- CNPG – Concrete Gravity
- CNPGRE – Concrete Gravity and Rolled Earth
- CNPGVA – Concrete Gravity Arch
- CNVA – Concrete Arch
- MS – Masonry
- MSRE – Masonry and Rolled Earth
- OT – Other
- RECNCB – Rolled Earth and Concrete Buttress
- RECNPG – Rolled Earth and Concrete Gravity
- REER – Rolled Earth and Rockfill
- REMS – Rolled Earth and Masonry
- STMS – Stone Masonry
- STMSRE – Stone Masonry and Rolled Earth
- TC – Timber Crib

Detention
Surface collection, storage, and distribution of stormwater runoff for the purposes of compensating for increased runoff volume and decreased travel time associated with an increase in impervious surfaces over the contributing catchment, and to allow for the settling-out of pollutants borne by the runoff.

Development
Any land-disturbing activity that changes the amount of impervious surface or partially impervious surface coverage on the land, or that otherwise decreases the infiltration of precipitation into the soil.

Disaster/Emergency
Any hurricane, tornado, storm, flood, high water, wind driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion or other catastrophe in any part of the United States which, in the determination of the President, caused damage of sufficient severity and magnitude to warrant major disaster assistance under P.L. 93-288, above and beyond emergency services by the federal government, to supplement the efforts and available resources of the state, local government and disaster relief organization in alleviating damage, loss, hardship or suffering.

Drainageway
Any stream, watercourse, channel, ditch, or similar physiographic feature draining water from the land.

EMS
Emergency Medical Services - Local medical response teams, usually rescue squads or local ambulance services, which provide medical services during a disaster.

EOC
Emergency Operations Center - A protected site from which government officials and emergency response personnel exercise direction and control in an emergency. The emergency Communications Center (ECC) is normally an essential part of the EOC.

EOP
Emergency Operations Plan - A brief, clear and concise description of action to be taken or instruction to be given to those concerned during a specific emergency. The plan will state the method or scheme for coordinated action based on pre-determined assumptions, objectives and capabilities.

EPA - U.S. Environmental Protection Agency

ETJ
Extraterritorial jurisdiction – that area of land outside and beyond the corporate limits of a municipality over which the municipality has planning and zoning jurisdiction.

FEMA
Federal Emergency Management Agency - A federal agency tasked with national disaster and emergency preparedness and response. FEMA also deals in temporary emergency housing, training of state and local emergency response personnel and funding of preparedness projects and functions.

FEMA Flood Zones

Zone A - Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs (base flood elevations) or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone AE and A1-A30 - Zones AE and A1-A30 are the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the FIS by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

Zone AH - Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding with a constant water-surface elevation (usually areas of ponding) where average depths are between 1 and 3 feet. The BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

Zone AO - Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. The depth should be averaged along the cross section and then along the direction of flow to determine the extent of the zone. Average flood depths derived from the detailed hydraulic analyses are shown within this zone. In addition, alluvial fan flood hazards are shown as Zone AO on the FIRM. Mandatory flood insurance purchase requirements apply.

Zone AR - Zone AR is the flood insurance rate zone used to depict areas protected from flood hazards by flood control structures, such as a levee, that are being restored. FEMA will consider using the Zone AR designation for a community if the flood protection system has been deemed restorable by a Federal agency in consultation with a local project sponsor; a minimum level of flood protection is still provided to the community by the system; and restoration of the flood protection system is scheduled to begin within a designated time period and in accordance with a progress plan negotiated between the community and FEMA. Mandatory purchase requirements for flood insurance will apply in Zone AR, but the rate will not exceed the rate for unnumbered A zones if the structure is built in compliance with Zone AR floodplain management regulations.

For floodplain management in Zone AR areas, elevation is not required for improvements to existing structures. However, for new construction, the structure must be elevated (or floodproofed for non-residential structures) such that the lowest floor, including basement, is a maximum of 3 feet above the highest adjacent existing grade if the depth of the base flood elevation (BFE) does not exceed 5 feet at the proposed development site. For infill sites, rehabilitation of existing structures, or redevelopment of previously developed areas, there is a 3 foot elevation requirement regardless of the depth of the BFE at the project site.

The Zone AR designation will be removed and the restored flood control system shown as providing protection from the 1% annual chance flood on the NFIP map upon completion of the restoration project and submittal of all the necessary data to FEMA.

Zone A99 - Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplains that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No BFEs or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone D - The Zone D designation on NFIP maps is used for areas where there are possible but undetermined flood hazards. In areas designated as Zone D, no analysis of flood hazards has been conducted. Mandatory flood insurance purchase requirements do not apply, but coverage is available. The flood insurance rates for properties in Zone D are commensurate with the uncertainty of the flood risk.

Zone V – Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no BFEs are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone VE - Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

Zones B, C, and X - Zones B, C, and X are the flood insurance rate zones that correspond to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

Flood or Flooding
A general and temporary condition of partial or complete inundation of normally dry land areas from: 1) the overflow of inland or tidal waters; and 2) the unusual and rapid accumulation of runoff of surface waters from any source.

Flood Hazard Boundary Map (FHBM)
An official map of a community, issued by the Federal Emergency Management Agency (FEMA), where the boundaries of the areas of special flood hazard have been defined as Zone A.

Flood Insurance Rate Map (FIRM)
An official map of a community on which the Federal Emergency Management Agency (FEMA) has delineated both the areas of special flood hazard and the risk premium zones applicable to the community.

Floodway
The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.

Mitigation
Any activity that actually eliminates or reduces the probability of a disaster occurrence, or reduces the effects of a disaster. Mitigation includes such actions as zoning and land use management, safety and building codes, flood proofing of buildings and public education.

National Warning System (NAWAS)
The federal warning system used to disseminate warnings of imminent natural disaster or enemy attack into a regional warning system which passes it to the state warning points for action.

National Weather Service (NWS)
A federal agency tasked with forecasting weather and providing appropriate warning of imminent natural disaster such as hurricane, tornados, tropical storms, etc.

NCEM
North Carolina Division of Emergency Management - The North Carolina state agency tasked with protecting the general public from the effects of natural or man-made disasters.

NCDC - National Climatic Data Center Storm Events Database
http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms)
The Storm Events Database is updated on a monthly basis and is usually 90-120 days behind the current month. All of the data is received from the National Weather Service and is made available as soon as possible. The National Climatic Data Center Storm Events Database contains data from the following sources:

1) All Weather Events from 1993 - 1995, as entered into Storm Data (except 6/93 - 7/93, which is missing; no latitude/longitude).
2) All Weather Events from 1996 - current, as entered into Storm Data (including latitude/longitude).
3) Additional data from the Storm Prediction Center including tornadoes (1950-1992); thunderstorm winds (1955-1992); and hail 1955-1992

Nonpoint Source Pollution
Pollution that enters waters from dispersed sources (such as surface runoff) rather than from a point source (i.e., pipe).

Recovery
Activities which involve assistance to enhance the return of the community to normal or near-normal conditions. Short-term recovery returns vital life-support systems to minimum operating standards. Long-term recovery may continue for a number of years after a disaster and seeks to return life to normal or improved levels. Recovery activities include temporary housing, loans or grants, disaster unemployment insurance, reconstruction and counseling programs.

Response
Activities that occur immediately before, during, and directly after an emergency or disaster. Activities involve lifesaving actions such as, the activation of warning systems, manning the EOCs, implementation of shelter or evacuation plans and search and rescue.

Retention
Surface collection, storage, and reduction of stormwater runoff for the purpose of providing infiltration of the runoff into the soil.

Runoff
That portion of rainfall or other precipitation that is not absorbed by the soil, but rather flows across the ground surface and drains to a water body.

SHELDUS – Spatial Hazard Events and Losses Database for the United States
http://go2.cla.sc.edu/hazard/db_registration
SHELDUS is a geo-referenced data set providing county-level data on natural hazard events and losses from 1960 to 2000. Hazard types covered in the data base include avalanches, coastal hazards, drought, earthquakes, flooding, fog, hail, heat, hurricane/tropical storms, landslides, lightning, severe storms/thunderstorms, tornadoes, tsunamis/seiches, volcanoes, wildfires, wind hazards, and winter weather. According to the SHELDUS website, this is the most comprehensive database of natural hazard events and losses available.

SHELDUS culls data from repositories such as the National Climatic Data Center Storm Data and the Council of National Seismic Systems. Variables include county name, state, Federal Information Processing Standard (FIPS) code, date, event type, property losses (in unadjusted dollars), crop losses (in unadjusted dollars), injuries, and deaths.

Only those events that generated more than $50,000 in losses are included in the database. For events that covered multiple counties, the dollar losses, deaths, and injuries were equally divided among the counties. Where dollar loss estimates were provided in a range (e.g., $50,000 to $100,000), the lowest value in the range of the category was used. This results in the most conservative estimate of losses during the time period.

USGS - United States Geological Survey.

Vulnerability
The susceptibility to life, property, and the environment to damage if a hazard manifests its potential.

Watershed
The land area that drains runoff to a surface water body or watercourse. Also called a drainage basin, a watershed includes hills, lowlands, and the body of water into which the runoff drains.

Watershed Buffer
An undisturbed area of natural vegetation adjacent to a drainageway, watercourse, or water impoundment within a watershed through which stormwater runoff is intended to flow in a diffuse manner so that it does not become channelized and infiltration of runoff and filtering of pollutants can take place.